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Emission Inventories for Urban Airshed Model Application in Tulsa, Oklahoma

Engineering-Science, Inc.
McLean, VA

Prepared for

Environmental Protection Agency
Research Triangle Park, NC

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16. ABSTRACT

This report describes the detailed development of a spatially and temporally resolved inventory for the Tulsa urban area. Hourly emission rates of paraffins, olefins, aromatics, carbonyls and ethylene, as well as NO, NO_2, CO, SO_x and particulate, were all estimated for each of 1550 (2 km square) grid cells comprising a 124 km by 50 km grid overlying Tulsa. The preparation of an Urban Airshed modelers tape is described.

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by

Engineering-Science
McLean, Virginia 22102

Contract No. 68-02-2584

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U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air, Noise, and Radiation
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CHAPTER I

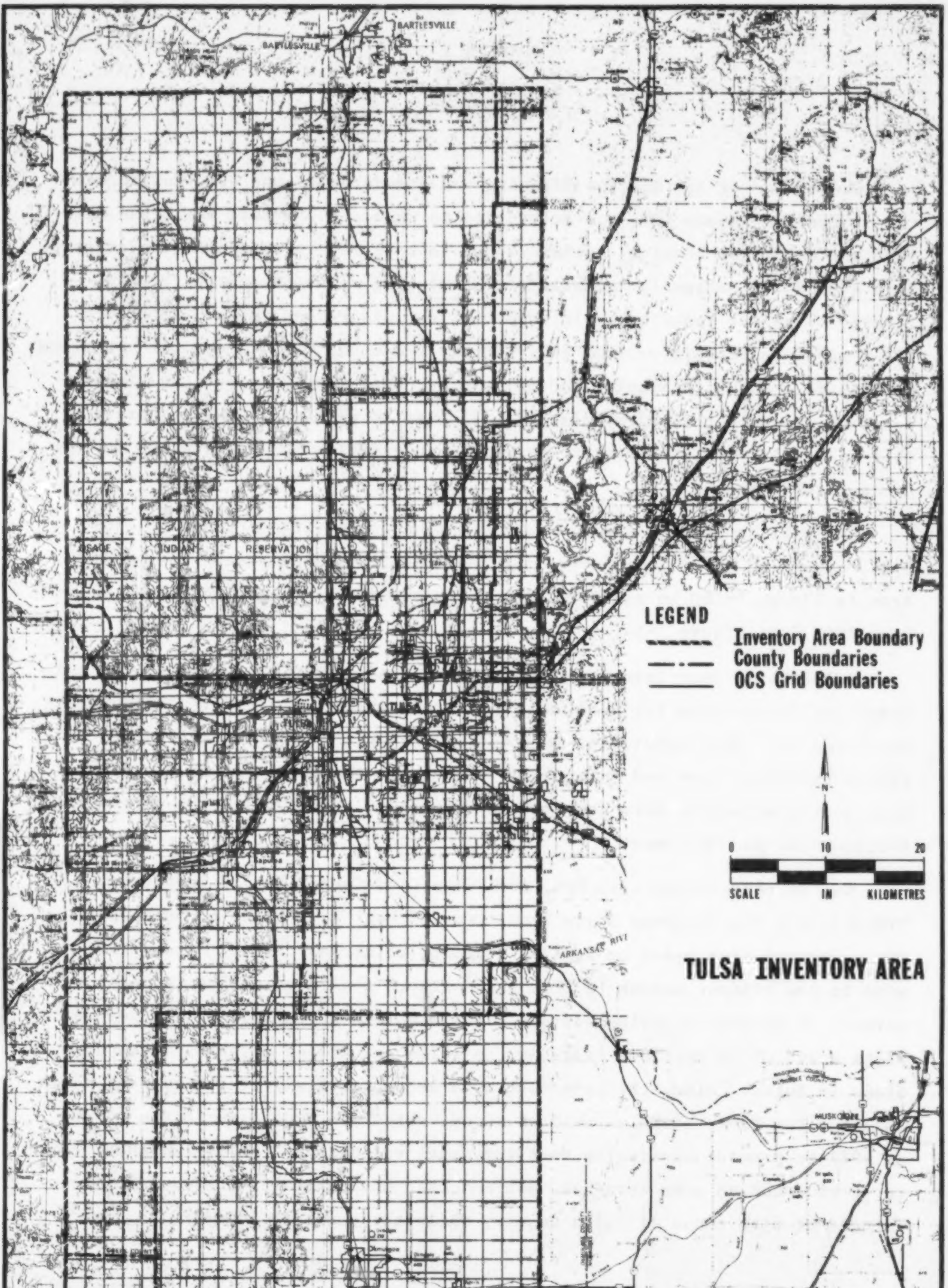
INTRODUCTION

The Office of Air Quality Planning and Standards of the U.S. Environmental Protection Agency (EPA) is attempting to validate and test the Urban Airshed photochemical chemical oxidant model in several cities around the country. Such a model is extremely important in developing accurate source receptor relationships for reactive pollutants that are discharged to the atmosphere. EPA's model validation program will compare the model predictions with measured ambient data and with simpler models such as EKMA. In addition, the significance of selected control strategies will also be examined. The purpose of this study is to create accurate emissions inventories for application to the Urban Airshed Model.

Engineering-Science (ES), under authorization of EPA Contract No. 68-02-2584, completed three inventories for the Tulsa, Oklahoma area. The study area is 124 km by 50 km and lies within the boundaries of the Northeast Oklahoma AQCR (see Figure I-1).

A 1977 base year inventory was completed under Work Assignment No. 5 and projected inventories for 1982 and 1987 were completed under Work Assignments No. 8 and 12. The inventories included all major and minor point sources within the study area and major point sources in the remainder of the AQCR. Area source emissions were compiled for the study area and for the cities of Bartlesville and Muskogee.

ES, in conjunction with EPA, the Tulsa City-County Health Department (TCCHD), and the Oklahoma State Department of Health, set the boundaries of the inventory area based on several relevant criteria. First, the typical wind in the oxidant season is from the southern quadrant, and it is more important to inventory upwind sources. The Okmulgee Refinery, located several miles south of Tulsa, is a large source which may affect oxidant concentrations in Tulsa. Also, the inventory area encompasses all of the ambient monitoring sites from the Tulsa oxidant study, which was conducted in the summer of 1977 to provide monitoring data for model validation. Utilizing these criteria produced an area that has east and west boundaries that are essentially coincident with those of Tulsa County, while the southern boundary is just


BARTLESVILLE
OSAGE INDIAN RESERVATION
TULSA
ARKANSAS RIVER
MUSKOGEE
N
0
10
20
SCALE IN KILOMETRES

LEGEND

Inventory Area Boundary
County Boundaries
OCS Grid Boundaries

TULSA INVENTORY AREA

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south of Okmulgee and the northern boundary is just south of the Bartlesville city limits.

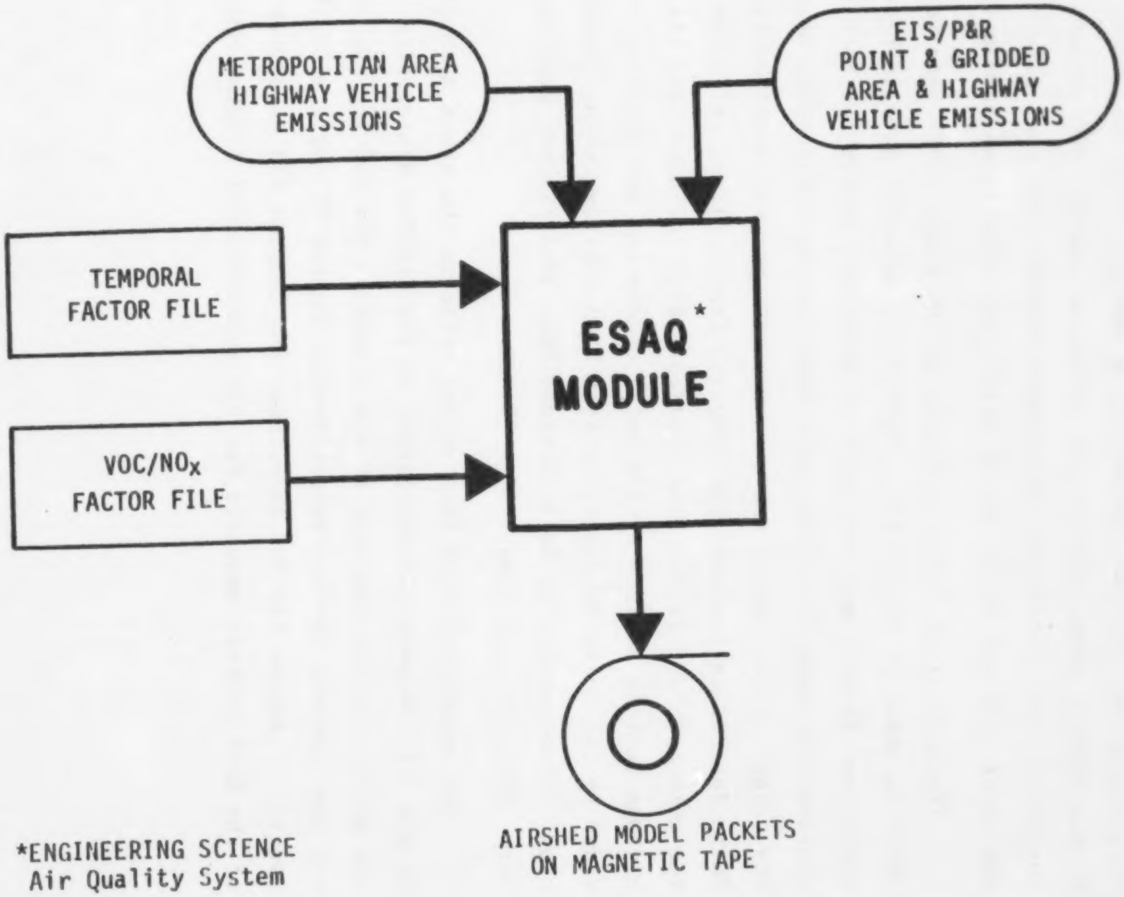
The annualized inventories were spatially and temporally refined by pollutant to generate the input data required by the Airshed Model. This required determining hourly emissions for a weekday representative of the oxidant season in Tulsa. Eleven categories of pollutants were inventoried: NO, NO_2, paraffins, olefins, carbonyls, aromatics, ethylene, non-reactive VOC, sulfur oxides, particulates, and carbon monoxide. The pollutants were inventoried for both mobile and stationary sources, and then allocated to a grid system of 1550 two km by two km grids, as illustrated in Figure I-1.

The general procedure utilized in the study (1977 base year, 1982, and 1987) is shown in Figure I-2. Annualized emission data in Emission Inventory Subsystem/ Permits and Registration (EIS/P&R) format for both point and area sources and other data files were input to the Engineering-Science Air Quality (ESAQ) system, which produced the data packets required for modeling. These data files included the temporal factor files, pollutant factors, and the emission factors for area sources. Also included were the data concerning highway vehicle sources within Tulsa County and metropolitan Osage County provided by the Tulsa Metropolitan Area Planning Commission (TMAPC). The TMAPC study is documented in Tulsa Metropolitan Area Highway Vehicle Emission Inventory EPA publication No. 450/4-79-029.

The organization of this report reflects the above methodology. Chapters II and III document the generation of the EIS/P&R master file for area sources and point sources; Chapters IV and V address the VOC and NO_x component splits and the temporal factors respectively; Chapter VI deals with the aldehyde correction procedure for VOC emissions; and Chapter VII describes the creation of the data packets required for the generation of Airshed Model input.

FIGURE I-2

ES PROCEDURE


METROPOLITAN AREA HIGHWAY VEHICLE EMISSIONS
EIS/P&R POINT & GRIDDED AREA & HIGHWAY VEHICLE EMISSIONS
TEMPORAL FACTOR FILE
VOC/NO$_x$ FACTOR FILE
ESAQ* MODULE
AIRSHED MODEL PACKETS ON MAGNETIC TAPE

*ENGINEERING SCIENCE
Air Quality System

CHAPTER II

ANNUALIZED AREA SOURCE INVENTORIES

INTRODUCTION

Area source emissions have been divided into 21 categories (Table II-1). This chapter deals with each separately. Other area sources, such as frost control and coal refuse burning, have been determined to be negligible for the Tulsa area.

The first section for each category describes the activity parameter upon which emissions were based. Appendix A contains the area source input forms for each county which have the actual activity figures used for each category. Three sets of forms are provided; one set for the base year inventory (1977) and one set for each of the projection year inventories (1982 and 1987). All contain annual figures. Besides Tulsa County and the other four counties in the study area, the cities of Bartlesville and Muskogee are represented, so that there are seven forms for each annual inventory.

As shown in Figure I-1, small portions of several other counties are included in the study area. In order to simplify the data input procedures, these areas were treated as if they were part of the nearest larger inventoried county (i.e., Creek, Osage, Washington, or Okmulgee).

The basic procedure for arriving at gridded annual emissions involved the manipulation of several individual data sets. First of all, the aforementioned county activity parameters were allocated to subcounty areas (the grid system). Then, the emission factor file was applied to generate annual emissions. Later, growth factors were applied to the county activity parameters in order to produce similar files for the 1982 and 1987 projections. The process was repeated for each inventory year.

In the development of the area source inventory, ES made use of all available inventorying data that had been accumulated previously. In their Area Source Emissions Inventory for Tulsa, Oklahoma, (Appendix D), TCCHD provided the basis for the development of the activity parameters for several of the area source categories. These categories were: gasoline marketing, oil and gas production, dry cleaning, cutback asphalt usage, on-site incineration, natural gas combustion, recreational vessel use, residential open burning, and soil farming. Many growth factors for the projection years came from the

TABLE II-1

CATEGORIES OF AREA SOURCES

1. Highway Motor Vehicles
2. Aircraft
3. Rail Locomotive
4. Vessels
5. Agricultural Equipment
6. Construction Equipment
7. Small Gasoline Engines
8. Gasoline Handling
9. Dry Cleaning
10. Degreasing, Surface Coating, and Miscellaneous Commercial/Consumer Solvent Use
11. Cutback Asphalt Paving
12. Pesticides Applications
13. Oil Wells and Gas Wells
14. On-Site Incineration
15. Open Burning
16. Natural Gas Use
17. Forest Fires
18. Agricultural Burning
19. Structural Fires
20. Natural Gas Leaks
21. Oily Waste Disposal (Soil Farming)

the Oklahoma State Department of Health and the Oklahoma Employment Security Commission as well as TCCHD. The result of the inventorying effort is an emissions summary for each of the inventory years. This summary is presented on a county-by-county basis in Table II-2A. Totals for each county are listed in Table II-2B.

The next three sections for each category address projection data, emission factors, and allocation methodologies. Each section contains the documentation upon which the figures were based, as well as any other assumptions used in their calculation. Some basic data appropriate for several categories will be discussed in the introduction.

Approximately one-third of the 1,550 grid cells lie within the Tulsa Metropolitan Area Planning Commission's (TMAPC) traffic zones. TMAPC was responsible for calculating highway motor vehicle emissions in this area. Also, through use of the Projected Land Use Model (PLUM), TMAPC supplied ES with base year and projection year traffic zone data including population, population-serving employment, total employment, number of dwelling units, and farmland acreage. Through the AQZTOGR computer program, ES was able to translate the data from a traffic zone format to Oklahoma Coordinate System (OCS) grid cells. For service stations and dry cleaners, ES made use of surveys taken by TCCHD (see Appendix D). A second AQZTOGR program was used to transform the data from TCCHD square mile grids to OCS grids.

Allocation Parameters

The base year (1977) population figures used in this study were taken from the Federal-State Cooperative Program for Local Population Estimates. The participants in the program were the U.S. Bureau of the Census and the Oklahoma Employment Security Commission (OESC). Population projections to 1982 and interpolations between 1977 and 1985, and 1985 and 1990, respectively. Table II-3 shows these figures for each county and city included in the area source inventory.

In order to achieve the degree of resolution needed outside Tulsa County for breaking down population estimates to subcounty units, further calculations were necessary. First of all, the number of inhabitants in each town within the study area was found in using the same sources as those used for the counties. Table II-4 lists all significant settlements in the study area and their base year populations. Available projection year figures were included.

TABLE II-2A

AREA SOURCE EMISSIONS SUMMARY

TULSA COUNTY

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Residential Natural Gas			
Particulates	77	81	84
Carbon Monoxide	153	161	168
Sulfur Oxides	5	5	5
Oxides of Nitrogen	613	646	672
Volatile Organic Compounds	61	65	67
Commercial Natural Gas			
Particulates	48	50	69
Carbon Monoxide	96	99	138
Sulfur Oxides	3	3	4
Oxides of Nitrogen	574	596	829
Volatile Organic Compounds	38	40	55
Industrial Natural Gas			
Particulates	116	142	168
Carbon Monoxide	197	241	285
Sulfur Oxides	7	8	10
Oxides of Nitrogen	1,394	1,700	2,015
Volatile Organic Compounds	35	42	51
On-Site Incineration			
Particulates	20	15	12
Carbon Monoxide	28	22	17
Sulfur Oxides	7	5	4
Oxides of Nitrogen	9	6	5
Volatile Organic Compounds	9	6	5
Residential Open Burning			
Particulates	112	94	73
Carbon Monoxide	593	499	389
Sulfur Oxides	7	6	5
Oxides of Nitrogen	42	35	27
Volatile Organic Compounds	209	176	137
Farm Gasoline			
Particulates	1	1	1
Carbon Monoxide	561	606	588
Sulfur Oxides	1	1	1
Oxides of Nitrogen	25	27	26
Volatile Organic Compounds	35	38	36

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

TULSA COUNTY

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Construction Gasoline			
Particulates	1	1	1
Carbon Monoxide	310	381	453
Sulfur Oxides	0	0	1
Oxides of Nitrogen	9	10	12
Volatile Organic Compounds	13	15	18
Small Gasoline Engines			
Particulates	7	7	7
Carbon Monoxide	2,438	2,515	2,638
Sulfur Oxides	3	3	4
Oxides of Nitrogen	27	28	29
Volatile Organic Compounds	288	297	311
Farm Diesel			
Particulates	8	8	8
Carbon Monoxide	20	22	21
Sulfur Oxides	5	6	5
Oxides of Nitrogen	56	61	59
Volatile Organic Compounds	12	13	13
Construction Equipment Diesel			
Particulates	197	242	288
Carbon Monoxide	737	906	1,078
Sulfur Oxides	257	316	376
Oxides of Nitrogen	3,473	4,268	5,081
Volatile Organic Compounds	301	370	440
Rail Locomotive			
Particulates	21	21	21
Carbon Monoxide	110	110	110
Sulfur Oxides	48	48	48
Oxides of Nitrogen	314	314	314
Volatile Organic Compounds	90	90	90
Military Aircraft			
Particulates	1	1	1
Carbon Monoxide	66	66	66
Sulfur Oxides	3	3	3
Oxides of Nitrogen	12	12	12
Volatile Organic Compounds	37	37	37

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

TULSA COUNTY

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Civil Aircraft			
Particulates	3	3	4
Carbon Monoxide	1,676	1,897	2,231
Sulfur Oxides	2	2	3
Oxides of Nitrogen	8	10	11
Volatile Organic Compounds	59	67	79
Commercial Aircraft			
Particulates	24	28	30
Carbon Monoxide	1,198	1,405	897
Sulfur Oxides	42	49	54
Oxides of Nitrogen	488	572	454
Volatile Organic Compounds	561	658	268
Vessels			
Carbon Monoxide	38	48	57
Sulfur Oxides	0	0	0
Oxides of Nitrogen	1	1	1
Volatile Organic Compounds	11	14	17
Oil Sludge Farming			
Volatile Organic Compounds	24	24	24
Oil Wells			
Volatile Organic Compounds	185	185	194
Gas Wells			
Volatile Organic Compounds	21	21	21
Cutback Asphalt			
Volatile Organic Compounds	624	315	21
Natural Gas Leaks			
Volatile Organic Compounds	216	180	117
Dry Cleaning			
Volatile Organic Compounds	591	614	639
Pesticides			
Volatile Organic Compounds	22	26	32

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

TULSA COUNTY

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Solvent Evaporation			
Volatile Organic Compounds	3,751	4,690	5,364
Gas Marketing			
Volatile Organic Compounds	2,886	3,577	4,436
Freeway Roads	(Data supplied by TMAPC)		
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Rural Roads	(Data supplied by TMAPC)		
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Urban Roads	(Data supplied by TMAPC)		
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Forest Fires			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Agricultural Burning			
Particulates	22	22	22
Carbon Monoxide	126	126	126
Volatile Organic Compounds	22	22	22
Structural Fires			
Particulates	462	480	500
Carbon Monoxide	1,359	1,412	1,470
Oxides of Nitrogen	54	56	59
Volatile Organic Compounds	109	113	118

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

OKMULGEE COUNTY

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Residential Natural Gas			
Particulates	7	8	8
Carbon Monoxide	14	15	16
Sulfur Oxides	0	0	0
Oxides of Nitrogen	58	60	63
Volatile Organic Compounds	6	6	6
Commercial Natural Gas			
Particulates	4	5	6
Carbon Monoxide	9	9	13
Sulfur Oxides	0	0	0
Oxides of Nitrogen	53	55	77
Volatile Organic Compounds	4	4	5
Industrial Natural Gas			
Particulates	7	9	10
Carbon Monoxide	12	14	17
Sulfur Oxides	0	1	1
Oxides of Nitrogen	84	103	121
Volatile Organic Compounds	2	3	3
On-Site Incineration			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Residential Open Burning			
Particulates	84	87	91
Carbon Monoxide	448	464	484
Sulfur Oxides	5	5	6
Oxides of Nitrogen	32	33	34
Volatile Organic Compounds	158	164	171
Farm Gasoline			
Particulates	0	0	0
Carbon Monoxide	352	345	332
Sulfur Oxides	0	0	0
Oxides of Nitrogen	16	15	15
Volatile Organic Compounds	22	22	21

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

OKMULGEE COUNTY

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Construction Gasoline			
Particulates	0	0	0
Carbon Monoxide	90	111	132
Sulfur Oxides	0	0	0
Oxides of Nitrogen	3	3	4
Volatile Organic Compounds	4	4	5
Small Gasoline Engines			
Particulates	0	0	0
Carbon Monoxide	153	158	164
Sulfur Oxides	0	0	0
Oxides of Nitrogen	1	2	2
Volatile Organic Compounds	18	18	19
Farm Diesel			
Particulates	5	5	5
Carbon Monoxide	13	12	12
Sulfur Oxides	3	3	3
Oxides of Nitrogen	36	35	34
Volatile Organic Compounds	8	8	7
Construction Equipment Diesel			
Particulates	5	7	8
Carbon Monoxide	21	26	31
Sulfur Oxides	7	9	11
Oxides of Nitrogen	101	125	148
Volatile Organic Compounds	9	11	13
Rail Locomotive			
Particulates	3	3	3
Carbon Monoxide	16	16	16
Sulfur Oxides	7	7	7
Oxides of Nitrogen	46	46	46
Volatile Organic Compounds	13	13	13
Military Aircraft			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

OKMULGEE COUNTY

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Civil Aircraft			
Particulates	0	0	0
Carbon Monoxide	195	220	259
Sulfur Oxides	0	0	0
Oxides of Nitrogen	1	1	1
Volatile Organic Compounds	7	8	9
Commercial Aircraft			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Vessels			
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Oil Sludge Farming			
Volatile Organic Compounds	0	0	0
Oil Wells			
Volatile Organic Compounds	146	146	154
Gas Wells			
Volatile Organic Compounds	445	445	466
Cutback Asphalt			
Volatile Organic Compounds	20	23	26
Natural Gas Leaks			
Volatile Organic Compounds	14	11	7
Dry Cleaning			
Volatile Organic Compounds	23	24	25
Pesticides			
Volatile Organic Compounds	13	16	19

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

OKMULGEE COUNTY

	EMISSIONS (TPY) YEAR		
CATEGORY	1977	1982	1987
Solvent Evaporation			
Volatile Organic Compounds	235	294	336
Gas Marketing			
Volatile Organic Compounds	13	17	20
Freeway Roads			
Particulates	361	372	397
Carbon Monoxide	1,587	1,347	911
Sulfur Oxides	15	14	16
Oxides of Nitrogen	324	282	232
Volatile Organic Compounds	267	166	90
Rural Roads			
Particulates	27	28	30
Carbon Monoxide	1,441	1,109	714
Sulfur Oxides	8	8	9
Oxides of Nitrogen	213	177	154
Volatile Organic Compounds	237	145	81
Urban Roads			
Particulates	6	6	7
Carbon Monoxide	734	571	381
Sulfur Oxides	2	2	2
Oxides of Nitrogen	40	33	28
Volatile Organic Compounds	87	61	39
Forest Fires			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Slash Burning			
Particulates	10	10	10
Carbon Monoxide	56	56	56
Volatile Organic Compounds	10	10	10
Structural Fires			
Particulates	19	21	22
Carbon Monoxide	56	60	65
Oxides of Nitrogen	2	2	3
Volatile Organic Compounds	4	4	5

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

CREEK COUNTY

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Residential Natural Gas			
Particulates	10	10	11
Carbon Monoxide	19	21	22
Sulfur Oxides	1	1	1
Oxides of Nitrogen	77	82	89
Volatile Organic Compounds	8	8	9
Commercial Natural Gas			
Particulates	6	7	9
Carbon Monoxide	10	12	17
Sulfur Oxides	0	0	1
Oxides of Nitrogen	71	87	103
Volatile Organic Compounds	2	2	3
Industrial Natural Gas			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
On-Site Incineration			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Residential Open Burning			
Particulates	79	85	91
Carbon Monoxide	421	450	484
Sulfur Oxides	5	5	6
Oxides of Nitrogen	30	32	34
Volatile Organic Compounds	148	159	171
Farm Gasoline			
Particulates	0	0	0
Carbon Monoxide	191	191	189
Sulfur Oxides	0	0	0
Oxides of Nitrogen	8	8	8
Volatile Organic Compounds	12	12	12

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

CREEK COUNTY

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Construction Gasoline			
Particulates	0	0	0
Carbon Monoxide	40	49	58
Sulfur Oxides	0	0	0
Oxides of Nitrogen	1	1	2
Volatile Organic Compounds	2	2	2
Small Gasoline Engines			
Particulates	0	0	0
Carbon Monoxide	121	130	140
Sulfur Oxides	0	0	0
Oxides of Nitrogen	1	1	2
Volatile Organic Compounds	14	16	16
Farm Diesel			
Particulates	3	3	2
Carbon Monoxide	6	6	6
Sulfur Oxides	2	2	2
Oxides of Nitrogen	18	18	18
Volatile Organic Compounds	4	4	4
Construction Equipment Diesel			
Particulates	3	3	4
Carbon Monoxide	9	12	14
Sulfur Oxides	3	4	5
Oxides of Nitrogen	44	55	65
Volatile Organic Compounds	38	48	57
Rail Locomotive			
Particulates	3	3	3
Carbon Monoxide	16	16	16
Sulfur Oxides	7	7	7
Oxides of Nitrogen	46	46	46
Volatile Organic Compounds	13	13	13
Military Aircraft			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

CREEK COUNTY

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Civil Aircraft			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Commercial Aircraft			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Vessels			
Carbon Monoxide	92	115	138
Sulfur Oxides	0	0	0
Oxides of Nitrogen	2	2	2
Volatile Organic Compounds	27	34	40
Oil Sludge Farming			
Volatile Organic Compounds	912	912	912
Oil Wells			
Volatile Organic Compounds	265	265	278
Gas Wells			
Volatile Organic Compounds	57	57	60
Cutback Asphalt			
Volatile Organic Compounds	22	25	28
Natural Gas Leaks			
Volatile Organic Compounds	11	9	6
Dry Cleaning			
Volatile Organic Compounds	30	32	34
Pesticides			
Volatile Organic Compounds	5	6	7

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

CREEK COUNTY

	EMISSIONS (TPY) YEAR		
CATEGORY	1977	1982	1987
Solvent Evaporation			
Volatile Organic Compounds	186	233	266
Gas Marketing			
Volatile Organic Compounds	15	19	23
Freeway Roads			
Particulates	130	134	143
Carbon Monoxide	571	484	328
Sulfur Oxides	5	5	6
Oxides of Nitrogen	117	102	83
Volatile Organic Compounds	96	60	33
Rural Roads			
Particulates	46	46	50
Carbon Monoxide	2,401	1,848	1,191
Sulfur Oxides	14	14	15
Oxides of Nitrogen	355	294	257
Volatile Organic Compounds	396	272	134
Urban Roads			
Particulates	17	17	19
Carbon Monoxide	2,079	1,618	1,078
Sulfur Oxides	5	5	6
Oxides of Nitrogen	114	94	81
Volatile Organic Compounds	248	173	112
Forest Fires			
Particulates	18	18	18
Carbon Monoxide	151	151	151
Oxides of Nitrogen	4	4	4
Volatile Organic Compounds	26	26	26
Slash Burning			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Volatile Organic Compounds	0	0	0
Structural Fires			
Particulates	15	16	17
Carbon Monoxide	44	46	50
Oxides of Nitrogen	2	2	2
Volatile Organic Compounds	4	4	4

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

OSAGE COUNTY

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Residential Natural Gas			
Particulates	7	7	7
Carbon Monoxide	13	14	14
Sulfur Oxides	0	0	0
Oxides of Nitrogen	53	55	57
Volatile Organic Compounds	5	6	6
Commercial Natural Gas			
Particulates	4	4	6
Carbon Monoxide	8	8	12
Sulfur Oxides	0	0	0
Oxides of Nitrogen	49	51	71
Volatile Organic Compounds	3	3	5
Industrial Natural Gas			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
On-Site Incineration			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Residential Open Burning			
Particulates	120	124	128
Carbon Monoxide	635	658	683
Sulfur Oxides	8	8	8
Oxides of Nitrogen	45	46	48
Volatile Organic Compounds	224	232	241
Farm Gasoline			
Particulates	0	0	0
Carbon Monoxide	249	236	214
Sulfur Oxides	0	0	0
Oxides of Nitrogen	11	10	10
Volatile Organic Compounds	16	15	13

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

OSAGE COUNTY

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Construction Gasoline			
Particulates	0	0	0
Carbon Monoxide	49	60	72
Sulfur Oxides	0	0	0
Oxides of Nitrogen	1	2	2
Volatile Organic Compounds	2	2	3
Small Gasoline Engines			
Particulates	0	0	0
Carbon Monoxide	65	68	70
Sulfur Oxides	0	0	0
Oxides of Nitrogen	1	1	1
Volatile Organic Compounds	8	8	8
Farm Diesel			
Particulates	3	3	3
Carbon Monoxide	9	8	8
Sulfur Oxides	2	2	2
Oxides of Nitrogen	25	24	22
Volatile Organic Compounds	5	5	5
Construction Equipment Diesel			
Particulates	3	4	5
Carbon Monoxide	12	14	17
Sulfur Oxides	4	5	6
Oxides of Nitrogen	55	68	80
Volatile Organic Compounds	5	6	7
Rail Locomotive			
Particulates	4	4	4
Carbon Monoxide	23	23	23
Sulfur Oxides	10	10	10
Oxides of Nitrogen	65	65	65
Volatile Organic Compounds	19	19	19
Military Aircraft			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

OSAGE COUNTY

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Civil Aircraft			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Commercial Aircraft			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Vessels			
Carbon Monoxide	200	251	301
Sulfur Oxides	0	1	1
Oxides of Nitrogen	4	5	6
Volatile Organic Compounds	58	73	88
Oil Sludge Farming			
Volatile Organic Compounds	0	0	0
Oil Wells			
Volatile Organic Compounds	292	339	393
Gas Wells			
Volatile Organic Compounds	19	21	26
Cutback Asphalt			
Volatile Organic Compounds	4	5	6
Natural Gas Leaks			
Volatile Organic Compounds	6	5	3
Dry Cleaning			
Volatile Organic Compounds	16	16	17
Pesticides			
Volatile Organic Compounds	12	16	23

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

OSAGE COUNTY

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Solvent Evaporation			
Volatile Organic Compounds	100	126	142
Gas Marketing			
Volatile Organic Compounds	6	8	10
Freeway Roads*			
Particulates	29	30	32
Carbon Monoxide	129	110	75
Sulfur Oxides	1	1	1
Oxides of Nitrogen	26	23	19
Volatile Organic Compounds	22	14	7
Rural Roads*			
Particulates	10	10	11
Carbon Monoxide	515	397	256
Sulfur Oxides	3	3	3
Oxides of Nitrogen	76	63	55
Volatile Organic Compounds	85	52	29
Urban Roads*			
Particulates	2	2	2
Carbon Monoxide	246	163	128
Sulfur Oxides	1	0	1
Oxides of Nitrogen	14	9	10
Volatile Organic Compounds	29	17	13
Forest Fires			
Particulates	19	19	19
Carbon Monoxide	158	158	158
Oxides of Nitrogen	4	4	4
Volatile Organic Compounds	27	27	27
Slash Burning			
Particulates	60	60	60
Carbon Monoxide	348	348	348
Volatile Organic Compounds	60	60	60
Structural Fires			
Particulates	8	8	8
Carbon Monoxide	24	23	25
Oxides of Nitrogen	1	1	1
Volatile Organic Compounds	2	2	2

* Part of highway vehicle emissions for Osage City are covered by TMAPC inventory. These estimates are for that are outside TMAPC's jurisdiction.

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

CITY OF MUSKOGEE

CATEGORY	EMISSIONS (TPY) YEAR 1977	 1982	 1987
Residential Natural Gas			
Particulates	8	9	9
Carbon Monoxide	16	17	19
Sulfur Oxides	-	1	1
Oxides of Nitrogen	63	69	76
Volatile Organic Compounds	6	7	8
Commercial Natural Gas			
Particulates	5	6	7
Carbon Monoxide	10	12	14
Sulfur Oxides	0	0	0
Oxides of Nitrogen	58	71	84
Volatile Organic Compounds	4	5	6
Industrial Natural Gas			
Particulates	20	24	29
Carbon Monoxide	34	42	49
Sulfur Oxides	1	1	2
Oxides of Nitrogen	241	294	349
Volatile Organic Compounds	6	7	9
On-Site Incineration			
Particulates	3	2	2
Carbon Monoxide	4	4	2
Sulfur Oxides	1	1	1
Oxides of Nitrogen	1	1	1
Volatile Organic Compounds	1	1	1
Residential Open Burning			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Farm Gasoline			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

CITY OF MUSKOGEE

	EMISSIONS (TPY) YEAR		
CATEGORY	1977	1982	1987
Construction Gasoline			
Particulates	0	0	0
Carbon Monoxide	56	70	83
Sulfur Oxides	0	0	0
Oxides of Nitrogen	2	2	2
Volatile Organic Compounds	2	3	3
Small Gasoline Engines			
Particulates	1	1	1
Carbon Monoxide	235	257	288
Sulfur Oxides	-	1	1
Oxides of Nitrogen	3	3	3
Volatile Organic Compounds	28	31	33
Farm Diesel			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Construction Equipment Diesel			
Particulates	4	4	5
Carbon Monoxide	13	17	20
Sulfur Oxides	5	6	7
Oxides of Nitrogen	63	78	93
Volatile Organic Compounds	5	7	8
Rail Locomotive	-	-	-
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Military Aircraft			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

CITY OF MUSKOGEE

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Civil Aircraft			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Commercial Aircraft			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Vessels			
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Oil Sludge Farming			
Volatile Organic Compounds	-	-	-
Oil Wells			
Volatile Organic Compounds	-	-	-
Gas Wells			
Volatile Organic Compounds	-	-	-
Cutback Asphalt			
Volatile Organic Compounds	99	112	127
Natural Gas Leaks			
Volatile Organic Compounds	21	18	12
Dry Cleaning			
Volatile Organic Compounds	50	54	60
Pesticides			
Volatile Organic Compounds	-	-	-

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

CITY OF MUSKOGEE

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Solvent Evaporation			
Volatile Organic Compounds	361	453	518
Gas Marketing			
Volatile Organic Compounds	392	486	603
Freeway Roads			
Particulates	654	674	496
Carbon Monoxide	2,870	2,242	1,139
Sulfur Oxides	26	25	20
Oxides of Nitrogen	587	512	289
Volatile Organic Compounds	484	301	113
Rural Roads			
Particulates	19	19	15
Carbon Monoxide	1,011	780	347
Sulfur Oxides	6	5	4
Oxides of Nitrogen	149	124	75
Volatile Organic Compounds	167	102	39
Urban Roads			
Particulates	249	255	192
Carbon Monoxide	30,661	24,044	10,995
Sulfur Oxides	78	78	60
Oxides of Nitrogen	1,684	1,388	822
Volatile Organic Compounds	3,655	2,563	1,136
Forest Fires			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Slash Burning			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Volatile Organic Compounds	-	-	-
Structural Fires			
Particulates	29	32	35
Carbon Monoxide	89	94	102
Oxides of Nitrogen	3	4	4
Volatile Organic Compounds	7	7	8

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

CITY OF BARTLESVILLE

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Residential Natural Gas			
Particulates	6	6	6
Carbon Monoxide	12	12	12
Sulfur Oxides	0	0	0
Oxides of Nitrogen	47	49	50
Volatile Organic Compounds	5	5	5
Commercial Natural Gas			
Particulates	4	4	5
Carbon Monoxide	7	9	10
Sulfur Oxides	0	0	0
Oxides of Nitrogen	43	53	62
Volatile Organic Compounds	3	4	4
Industrial Natural Gas			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
On-Site Incineration			
Particulates	2	2	1
Carbon Monoxide	4	2	2
Sulfur Oxides	1	1	1
Oxides of Nitrogen	1	1	1
Volatile Organic Compounds	1	1	1
Residential Open Burning			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Farm Gasoline			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

CITY OF BARTLESVILLE

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Construction Gasoline			
Particulates	0	0	0
Carbon Monoxide	113	139	166
Sulfur Oxides	0	0	0
Oxides of Nitrogen	3	4	5
Volatile Organic Compounds	5	6	7
Small Gasoline Engines			
Particulates	0	0	1
Carbon Monoxide	175	182	189
Sulfur Oxides	0	0	0
Oxides of Nitrogen	2	2	2
Volatile Organic Compounds	21	22	22
Farm Diesel			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Construction Equipment Diesel			
Particulates	7	9	11
Carbon Monoxide	27	33	39
Sulfur Oxides	9	12	14
Oxides of Nitrogen	127	156	186
Volatile Organic Compounds	11	14	16
Rail Locomotive			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Military Aircraft			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

CITY OF BARTLESVILLE

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Civil Aircraft			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Commercial Aircraft			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Vessels			
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Oil Sludge Farming			
Volatile Organic Compounds	-	-	-
Oil Wells			
Volatile Organic Compounds	13	13	14
Gas Wells			
Volatile Organic Compounds	-	-	-
Cutback Asphalt			
Volatile Organic Compounds	81	92	104
Natural Gas Leaks			
Volatile Organic Compounds	15	13	8
Dry Cleaning			
Volatile Organic Compounds	48	50	51
Pesticides			
Volatile Organic Compounds	-	-	-

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

CITY OF BARTLESVILLE

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Solvent Evaporation			
Volatile Organic Compounds	268	336	383
Gas Marketing			
Volatile Organic Compounds	323	402	497
Freeway Roads			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Rural Roads			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Sulfur Oxides	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Urban Roads			
Particulates	270	274	297
Carbon Monoxide	33,164	25,822	17,201
Sulfur Oxides	84	84	94
Oxides of Nitrogen	1,822	1,491	1,286
Volatile Organic Compounds	3,954	2,753	1,778
Forest Fires			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Oxides of Nitrogen	-	-	-
Volatile Organic Compounds	-	-	-
Slash Burning			
Particulates	-	-	-
Carbon Monoxide	-	-	-
Volatile Organic Compounds	-	-	-
Structural Fires			
Particulates	22	26	23
Carbon Monoxide	64	77	69
Oxides of Nitrogen	3	3	3
Volatile Organic Compounds	5	6	5

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

WASHINGTON COUNTY

	EMISSIONS (TPY) YEAR		
CATEGORY	1977	1982	1987
Residential Natural Gas			
Particulates	9	9	9
Carbon Monoxide	18	18	19
Sulfur Oxides	1	1	1
Oxides of Nitrogen	73	74	74
Volatile Organic Compounds	7	7	7
Commercial Natural Gas			
Particulates	6	7	8
Carbon Monoxide	11	14	16
Sulfur Oxides	0	0	0
Oxides of Nitrogen	67	82	97
Volatile Organic Compounds	4	5	6
Industrial Natural Gas			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
On-Site Incineration			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Residential Open Burning			
Particulates	53	53	54
Carbon Monoxide	281	284	287
Sulfur Oxides	3	3	3
Oxides of Nitrogen	20	20	20
Volatile Organic Compounds	99	100	101
Farm Gasoline			
Particulates	0	1	1
Carbon Monoxide	208	221	229
Sulfur Oxides	0	0	0
Oxides of Nitrogen	9	10	10
Volatile Organic Compounds	13	14	14

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

WASHINGTON COUNTY

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Construction Gasoline			
Particulates	0	0	0
Carbon Monoxide	4	5	5
Sulfur Oxides	0	0	0
Oxides of Nitrogen	1	1	2
Volatile Organic Compounds	2	2	2
Small Gasoline Engines			
Particulates	0	0	0
Carbon Monoxide	41	42	43
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	5	5	5
Farm Diesel			
Particulates	3	3	3
Carbon Monoxide	7	7	7
Sulfur Oxides	2	2	2
Oxides of Nitrogen	18	19	20
Volatile Organic Compounds	4	4	4
Construction Equipment Diesel			
Particulates	2	3	3
Carbon Monoxide	9	11	13
Sulfur Oxides	3	4	5
Oxides of Nitrogen	42	53	61
Volatile Organic Compounds	4	5	5
Rail Locomotive			
Particulates	2	2	2
Carbon Monoxide	13	13	13
Sulfur Oxides	6	6	6
Oxides of Nitrogen	37	37	37
Volatile Organic Compounds	11	11	11
Military Aircraft			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

WASHINGTON COUNTY

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Civil Aircraft			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Commercial Aircraft			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Vessels			
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Oil Sludge Farming			
Volatile Organic Compounds	0	0	0
Oil Wells			
Volatile Organic Compounds	204	204	214
Gas Wells			
Volatile Organic Compounds	2	2	2
Cutback Asphalt			
Volatile Organic Compounds	9	11	12
Natural Gas Leaks			
Volatile Organic Compounds	3	3	2
Dry Cleaning			
Volatile Organic Compounds	10	10	10
Pesticides			
Volatile Organic Compounds	8	10	13

TABLE II-2A (Continued)

AREA SOURCE EMISSIONS SUMMARY

WASHINGTON COUNTY

CATEGORY	EMISSIONS (TPY) YEAR 1977	1982	1987
Solvent Evaporation			
Volatile Organic Compounds	58	72	84
Gas Marketing			
Volatile Organic Compounds	7	8	10
Freeway Roads			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Rural Roads			
Particulates	31	31	34
Carbon Monoxide	1,622	1,249	805
Sulfur Oxides	9	9	10
Oxides of Nitrogen	240	199	174
Volatile Organic Compounds	267	163	91
Urban Roads			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Sulfur Oxides	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Forest Fires			
Particulates	0	0	0
Carbon Monoxide	0	0	0
Oxides of Nitrogen	0	0	0
Volatile Organic Compounds	0	0	0
Slash Burning			
Particulates	12	12	12
Carbon Monoxide	70	70	70
Volatile Organic Compounds	12	12	12
Structural Fires			
Particulates	5	5	5
Carbon Monoxide	14	16	16
Oxides of Nitrogen	1	1	1
Volatile Organic Compounds	1	1	1

TABLE II-2B

AREA SOURCE EMISSIONS SUMMARY

COUNTY TOTALS

EMISSIONS (TPY)

COUNTY	YEAR	PART	CO	SO_x	NO_x	VOC
Tulsa	1977	1,120	9,706	390	7,099	10,210
	1982	1,194	9,852	455	8,342	11,695
	1987	1,289	10,732	523	9,606	12,612
Okmulgee	1977	538	5,197	47	1,010	1,765
	1982	561	4,543	49	972	1,623
	1987	597	3,603	55	962	1,550
Creek	1977	330	6,171	42	954	2,541
	1982	342	5,149	43	892	2,391
	1987	367	3,822	49	860	2,250
Osage	1977	269	2,683	29	430	1,025
	1982	275	2,539	30	427	1,077
	1987	285	2,404	32	451	1,153
Muskogee (City)	1977	992	34,999	117	2,854	5,288
	1982	1,032	27,579	118	2,546	4,157
	1987	791	13,058	96	1,798	2,684
Bartlesville (City)	1977	311	33,543	94	2,048	4,753
	1982	321	26,276	97	1,759	3,717
	1987	344	17,688	109	1,595	2,895
Washington	1977	123	2,399	24	508	730
	1982	126	1,950	25	496	649
	1987	131	1,523	27	496	606

TABLE II-3

POPULATIONS OF COUNTIES AND CITIES IN THE TULSA INVENTORY AREA

AREA	1977 POPULATION	1982 POPULATION	1987 POPULATION
Creek County	53,200	56,600	60,400
Okmulgee County	37,400	38,600	40,200
Osage County	33,800	34,900	36,100
Tulsa County	428,700	445,500	463,400
Washington County	42,700	43,100	43,600
Bartlesville (city)	30,700	32,000	33,100
Muskogee (city)	41,300	45,200	49,000

TABLE II-4

POPULATIONS OF MAJOR TOWNS IN TULSA INVENTORY AREA

COUNTIES	1977	1982	1987
Osage County			
Avant	450	470	520
Barnsdall	1,600	1,620	1,670
Nelagoney	100	---	---
Skiatook	3,900	4,770	5,550
Washington County			
Ochelata	350	370	420
Ramona	600	620	670
Okmulgee County			
Morris	1,400	1,510	1,660
Preston	250	---	---
Beggs	1,550	1,750	2,050
Okmulgee	6,400	17,080	17,850
Creek County			
Slick	200	250	260
Mounds	1,000	1,200	1,500
Sapulpa	6,700	17,500	18,600
Kellyville	950	1,120	1,450
Oakhurst	2,000	---	---

Next the total county populations were reduced by the number of people living outside the study-area portions of the counties. For example, the city of Bartlesville lies outside the rectangular study area, yet is part of Washington County. Therefore, the starting point for determining the study-area population was subtracting the Bartlesville population of 30,700. Table II-5 lists each county in the study area and their base-year study-area populations.

To finally estimate the number of people in each OCS grid, a rural population density was found for each county. After the cities and towns in Table II-3 had been accounted for, the remaining population in the study area was spread uniformly over the rural areas. By inspecting the 1:24,000 USGS topographic maps for evidence of developments or housing units, it was determined whether the rural density figure should be increased for a particular grid. Since traffic zone data was available for the entire area of Tulsa County, this procedure was necessary for only the four other counties.

Other general surrogate parameters used in area source allocations include dwelling units, total employment, and commercial employment. Each of these parameters was broken down for the traffic zones in the PLUM output. Since the traffic zone area included all of the Tulsa County and metropolitan Osage County, PLUM accounted for allocating the great majority of the inventory area's emissions allocated by these parameters. The following section describes the general methods used to expand the data base to those mostly rural areas outside the traffic zones but still within the inventory area.

For dwelling units outside Tulsa County, the major source was Detailed Housing Characteristics, published as a part of the 1970 census of housing by the U.S. Department of Commerce. County totals were disaggregated on the basis of population. Similarly, employment statistics were obtained from OESC on a county basis.

Other allocation parameters are of a more specific nature. They are discussed in the allocation section of each category.

In many cases, ES found after investigation that projection year allocations were the same as the base year allocations. Unless specifically stated otherwise in the allocation section for a particular category, the projection year allocation parameters were identical to the base year.

TABLE II-5

STUDY-AREA PORTIONS OF COUNTY POPULATIONS

COUNTY	TOTAL 1977 POPULATION	% IN STUDY AREA (AREA BASIS)	STUDY-AREA POPULATION
Creek	53,200	40	21,300
Okmulgee	37,400	50	26,900
Osage	33,800	30	11,400
Washington	42,700	50	7,000
Tulsa	428,700	100	428,700

1. HIGHWAY MOTOR VEHICLES

TMAPC provided gridded hourly emissions for that portion of the inventory area within the traffic zones. This includes all of Tulsa County and metropolitan Osage County, which contains a great majority of all VMT for the study area.

For areas outside the traffic zones, various data were collected from the Oklahoma Department of Transportation (ODOT). Maps detailing average 1977 daily traffic volumes for the State Highway System, County Roads, and City Streets were consulted. The figures obtained from these maps were then matched to road segments found on U.S. Geological Survey maps (1:24,000 scale) which had been marked with appropriate grid boundaries. Having segment length and ADT, enabled the calculation of VMT by grid. Three road classifications were used for classifying emissions: limited access roads; rural roads (principal arterials); and urban or local roads.

Separate maps obtained from ODOT were used to calculate VMT for the cities of Bartlesville and Muskogee. The same three road classifications were used.

Projections

As was the case for the base year, 1982 and 1987 VMT were calculated by TMAPC for the area within the traffic zones. For the other areas, a factor of 2-1/2% increase per year was recommended by both TMAPC and ODOT. The 2-1/2% per annum increase was applied to VMT in all base year grids. Also, highway construction plans for 1982 introduced some additional VMT. These grids are shown in Table II-6.

Conversations with Carl Miller of the Oklahoma Department of Transportations indicated that beyond 1982, no new roads are being planned. Contributing factors to this decision include the energy shortage and inflation in the cost of petroleum products. Therefore, no new highways were included in the 1987 inventory for this category. However, the total VMT in 1982 was increased by 2-1/2% per year to obtain the 1987 inventory.

Emission Factors

The Mobile 1 computerized model for estimating highway vehicle emissions was utilized for all three inventories. TMAPC was responsible for traffic zone data. Input data for the other sections of the inventory area were

TABLE II-6

NEW HIGHWAYS PLANNED FOR 1982

DESCRIPTION	GRID #	ROAD CLASS	1982 DAILY VMT* (hundreds)
Pawhuska Bypass	758370	Rural	16
	758368	Rural	16
	758366	Rural	16
	758364	Rural	16
1-1/2 mi south of Sapulpa	770294	Urban	48
Sapulpa west to U.S. 66	768296	Urban	48

* Assumed to be new rather than displaced VMT.

supplied by ODOT. This information included average speeds and vehicle mix by road class, and percent cold and hot starts. Tables II-7A and II-7B list this input data. An oxidant season ambient temperature of 85°F was assumed. Three separate runs were made, one each for the calendar years 1977, 1982, and 1987. Emission factors in grams/VMT for carbon monoxide, VOC, and nitrogen oxides were estimated by this method. They are shown in Appendix F.

ES obtained SO_x and TSP emission factors from AP-42. Table II-7C shows emission factors for each pollutant by inventory year.

Allocation

Allocation was made to individual grids by VMT. The specific unit used was hundreds of daily VMT for each road class. Allocation for 1982 was changed from 1977 through the addition of the highways indicated in Table II-6. Allocation factors for 1987 were the same as 1982, since no new roads were expected.

2. AIRCRAFT

The county activity parameter associated with aircraft emissions is landing and takeoff cycles (LTO's) by aircraft type. In the inventory area, the largest airports are the Tulsa International and the Richard L. Jones (formerly Riverside) Airports. Base year data were acquired through telephone conversations with the airport managers at these airports and at three others: The Tulsa Downtown Airport (formerly North Tulsa Airport), the Harvey Young Airport, and the Okmulgee Airport. Table II-8 shows the breakdown of LTO cycles for each airport by type of aircraft.

Projections

All projection data were taken from "Airport Master Plan, Vol. 3, Assessments". This reference, printed by the Tulsa International Airport Authority, gives projections for LTO operations by type of aircraft for 1980, 1985, and 1995. Sorting the data into the classifications used on the NEDS coding sheet resulted in the growth factors shown in Table II-9. Each factor is expressed relative to the base year and was calculated through linear interpolation.

Although the "Airport Master Plan" document refers to Tulsa International Airport only, the growth factors that were generated are assumed to be valid for each of the smaller airports in the inventory area.

TABLE II-7A

DISTRIBUTION OF OPERATING MODE AND AVERAGE SPEED FOR TULSA ENVIRONS

	PERCENTAGE					
	COLD START	HOT START	STABLE MODE	SPEED MPH 1977	1982	1987
Highway	5	5	90	55	52	49
Principal Artery	10	10	80	45	43	42
Local	21	27	52	20	20	20

TABLE II-7B

DISTRIBUTION OF VMT BY VEHICLE CLASS FOR DIFFERENT ROAD TYPES

	VEHICLE CLASS					
ROAD TYPE	LDV %	LDT-1 % L6000	LDT-2 % L8500	HDG %	HDD %	MC %
Freeway and Highway	73.8	18.0	3.0	2.0	3.0	0.2
Principal Arterial (Rural)	82.8	14.0	2.0	0.5	0.5	0.2
CBD, Collector, Local (Urban)	78.2	12.8	3.6	1.7	0.7	3.0

TABLE II-7C

COMPOSITE EMISSION FACTORS FOR HIGHWAY MOTOR VEHICLES, GM/MILE

YEAR	POLLUTANT	LIMITED ACCESS	RURAL	URBAN
1977	HC	4.12	4.33	7.40
1982	HC	2.27	2.34	4.56
1987	HC	1.09	1.15	2.60
1977	CO	24.46	26.27	62.07
1982	CO	18.37	17.90	42.77
1987	CO	10.97	10.18	25.15
1977	NO_x	5.00	3.88	3.41
1982	NO_x	3.85	2.85	2.47
1987	NO_x	2.79	2.20	1.88
1977	SO_x	0.22	0.15	0.16
1982	SO_x	0.19	0.13	0.14
1987	SO_x	0.19	0.13	0.14
1977	TSP	0.56	0.50	0.50
1982	TSP	0.51	0.45	0.45
1987	TSP	0.48	0.43	0.43

TABLE II-8

AIRCRAFT EMISSION, 1977 C.Y.

			EMISSION FACTORS (lbs/LTO-engine)				
AIRCRAFT TYPE	AVERAGE # ENGINES	LTO CYCLES	PARTICULATE	SO_x	CO	VOC	NO_x
INTERNATIONAL AIRPORT							
AIR CARRIER							
Long-Range Jet (707)	4	4,690	1.21	1.56	47.4	41.2	7.9
Medium-Range (DC 9, 727)	2.75	18,759	0.41	1.01	17.0	4.9	10.2
AIR TAXI							
Piston Transport	4	480	0.56	0.28	304.0	40.7	0.40
Turboprop	2	4,320	0.20	0.18	3.1	1.1	1.2
MILITARY							
Military Jet	2	3,574	0.31	0.76	15.1	9.93	3.29
Military Piston	1	150	0.28	0.14	152.0	20.4	0.20
Helicopter	2	38	0.25	0.18	5.7	0.52	0.57
GENERAL AVIATION							
Business Jet	2	23,836	0.11	0.37	15.8	3.6	1.6
Turboprop	2	35,754	0.20	0.18	3.1	1.1	1.2
Piston	1	11,918	0.02	0.014	12.2	0.40	0.047
RICHARD L. JONES AIRPORT							
GENERAL AVIATION							
A. Itinerant							
Business Jet	2	786	0.11	0.37	15.8	3.6	1.6
Single-Engine piston	1	66,790	0.02	0.014	12.2	0.40	0.047
Twin-Engine piston	2	11,001	0.02	0.014	12.2	0.40	0.047
B. Local							
Single-Engine piston	1	77,601	0.02	0.014	12.2	0.40	0.047
AIR TAXIS							
Turboprop	2	230	0.20	0.18	3.1	1.1	1.2
MILITARY (helicopters)	2	7	0.25	0.18	5.7	0.52	0.57
TULSA DOWNTOWN AIRPARK (formerly North Tulsa Airport)							
Single-Engine Piston	1	21,600	0.02	0.014	12.2	0.40	0.047

TABLE II-8 (Continued)

AIRCRAFT EMISSION, 1977 C.Y.

AIRCRAFT TYPE	AVERAGE # ENGINES	LTO CYCLES	EMISSION FACTORS (lbs/LTO-engine) PARTICULATE	SO_x	CO	VOC	NO_x
HARVEY YOUNG AIRPORT							
Single-engine piston	1	5,400	0.02	0.014	12.2	0.40	0.047
OKMULGEE AIRPORT							
Business Jet	2	1,095	0.11	0.37	15.8	3.6	1.6
Double-engine piston	2	2,920	0.02	0.014	12.2	0.40	0.047
Single-engine piston	1	25,550	0.02	0.014	12.2	0.40	0.047

TABLE II-9

GROWTH FACTORS FOR AIRCRAFT CATEGORIES

AIRCRAFT CLASSIFICATION	1982 FACTOR*	1987 FACTOR*
Military	1.000	1.000
Civil	1.132	1.330
Commercial	1.172	1.290

* Projected from a 1977 basis.

Emission Factors

All emission factors were taken directly from AP-42. They are listed according to aircraft type, as shown in Table II-8. Idle times were assumed to be the same as those assumed in AP-42.

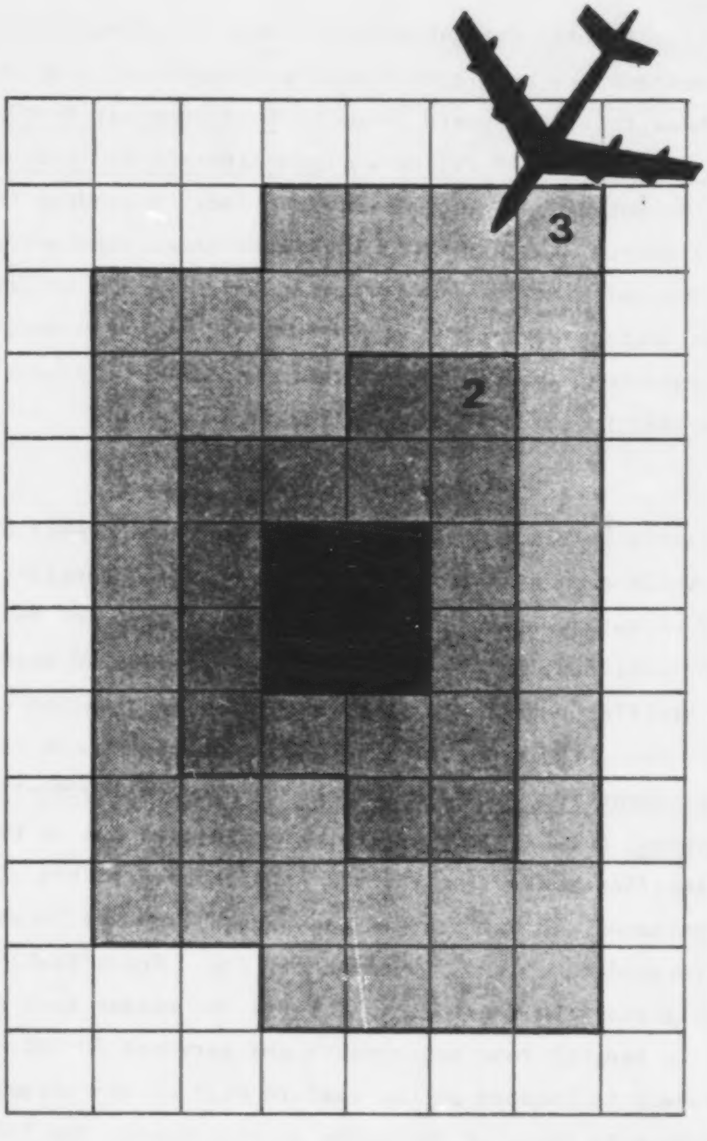
The emission factors for jet aircraft were modified for the 1987 projection year to reflect new regulations that are expected to go into effect before 1985. These regulations are found in Environmental Protection Agency Regulation on Control of Air Pollution from Aircraft and Aircraft Engines published by the Bureau of National Affairs, Inc. According to Dr. Munt of the EPA Mobile Source Lab, Ann Arbor Michigan; these regulations imply a 90% reduction in VOC emissions, a 60% reduction in CO, and a 40% reduction in NO_x. These percentage reductions apply to aircraft which account for 70% of all aircraft emissions in the Tulsa inventory area. They were assumed to fully affect the 1987 inventory for jet aircraft only.

Allocation

It was initially assumed that emissions would be evenly distributed to all grids in which each airport is located. However, considering the nature of the higher emissions at Tulsa International Airport due to medium- and long-range jet activity, a more detailed study was deemed appropriate. Jack Hardy of air traffic control was able to provide information concerning landing patterns. Using the criteria of a 3500-foot "emissions ceiling" as detailed in Procedures for the Preparation of Emission Inventories for Volatile Organic Compounds, a total of 56 grids were assigned one of the three aircraft emissions classifications. The factors considered for this allocation include: 1) windrose patterns, 2) air traffic patterns, 3) runway locations, and 4) the distance corresponding to the 3500-foot ceiling. Specifically, the windrose is heavily weighted from the south. This is the reason that the major runway (10,000 feet in length) runs north-south and services 70-80% of all jet flights. Since this runway is located on the eastern half of the airport area, allocation was weighted in favor of the grids in this area. The 3500-foot level was estimated to be reached within 12 kilometers of the center of the airport. Also, using a 45-degree intercept to the guide slope, more approaches were made from the north-east direction (30-40%) than the other three directions. Figure II-1 shows how emissions were allocated at Tulsa International Airport using these criteria.

FIGURE II-1

AIRCRAFT EMISSIONS ALLOCATIONS AT TULSA INTERNATIONAL AIRPORT



Emissions are equally partitioned into three zones:

Zone 1 - Airport Location (4 grids)
Zone 2 - Near Periphery (16 grids)
Zone 3 - Outside Periphery (36 grids)

Scale: 1 Grid Length = 2 km

Since the other airports in the inventory area do not service the larger jets, allocations were made to grids covering the airport location only. Also, no new airports are expected to be constructed within the time frame of the projection year inventories.

3. RAIL LOCOMOTIVE

The St. Louis-San Francisco Railway Co. is the leading locomotive freight company in the Tulsa area. There is no locomotive passenger service available. Other railway companies dealing in the Tulsa area were identified through The Official Railway Guide, and all were contacted for fuel-consumption data. Table II-10 contains the estimated annual 1977 fuel consumption obtained by these contacts. These figures were extrapolated to other counties in the study area by using track length ratios.

Projections

Martin Pomphrey of SLSF Co. indicated that the best estimate of future railroad locomotive activity would be to simply assume no change from present levels. Although one of the minor freight companies expressed an interest in adding a new shift by 1982, present activity levels were assumed for both 1982 and 1987. Verification was found in the OBERS projections from the U.S. Department of Commerce. This reference predicts no change in railroad earnings for the Tulsa area until 1990, when a gradual decrease in earnings will begin.

Emission Factors

Two sets of emission factors have been used to find one "weighted average" set of factors that would be applicable to the Tulsa area. Fifteen percent of the fuel consumption corresponded to the emission factors for a "supercharged two-stroke switch engine."

This type of fuel consumption applied to KATY and Midland Valley rail operations. The remainder was attributed to average locomotive emission factors based on national statistics. The actual factors used are listed in Table II-11. AP-4 was the source of all data.

Allocation

Most of the fuel consumption is due to switching operations. Since switching is done in various locations all over the inventory area, emissions were allocated by length of track. U.S. Geological Survey quad maps were used

TABLE II-10

ESTIMATED 1977 LOCOMOTIVE FUEL CONSUMPTION

RAILWAY CO.	ANNUAL FUEL USE (Tulsa Co.)
St. Louis-San Francisco Co.	1,365,000 gal
Missouri-Kansas-Texas (KATY)	187,500 gal
Missouri-Pacific (Midland Valley)	62,600 gal
Sand Springs	52,000 gal
Atchison Topeka and Sante Fe	32,500 gal

TABLE II-11

RAIL LOCOMOTIVE COMPOSITE EMISSION FACTORS

POLLUTANT TYPE	EMISSION FACTOR
Particulate	25 lb/1000 gal fuel
SO_x	57 lb/1000 gal fuel
CO	123 lb/1000 gal fuel
HC	121 lb/1000 gal fuel
NO_x	352 lb/1000 gal fuel

to relate track length to grid numbers. Due to the fact that no change in railroad operations was expected from 1977 through 1987, the base and projection year allocation factors remained the same.

4. VESSELS

Since the Port of Catoosa is located outside the inventory area (Wagoner County), all vessel usage included in the study was recreational in nature. Two lakes were inventoried, Lake Heyburn and Keystone Lake. Both are located on the western edge of the inventory area.

Emissions from vessels depend upon fuel use by type of vessel. From Procedures for the Preparation of Emission Inventories for Volatile Organic Compounds an average of 2.0 gallons per hour of boat use was assumed. This figure coincides with a ratio of outboard to inboard vessels of 2-1. This ratio was estimated by Grady Barrons of TCCHD, as were the figures for number of vessels. For Keystone Lake, a total of 95,410 boat-days per year was calculated from the estimated number of boats. Multiplying by TCCHD's factor of 2 hours per boat-day (motor-running hours) and by the 2.0 gallons per hour figure, it was calculated that 380,000 gallons of fuel were used in Keystone Lake for 1977. Since only half of Keystone Lake is in the inventory area, the figure of 190,000 gallons of fuel was used for the total annual fuel use. Lake Heyburn was estimated to have about one-third the emissions of Keystone Lake, since it has one-third the water surface area. Therefore, a figure of 63,000 gallons was used.

Projections

TCCHD officials estimated a 25% increase over 1977 recreational fuel use for 1982. For 1987, a figure 50% higher than 1977 was suggested.

Emission Factors

Emissions were calculated from AP-42 using the assumption that one-third of the recreational vessels were inboard and the remainder outboard. These figures are shown in Table II-12.

Allocation

Allocation for this category was determined by estimating vessel miles travelled in each grid. U.S. Geological Survey quad maps were consulted as to the amount of lake within each appropriate grid.

TABLE II-12

COMPOSITE EMISSION FACTORS FOR RECREATIONAL VESSELS

POLLUTANT	EMISSIONS (lb/100 gal)
SO_x	0.64
CO	261.3
HC	76.2
NO_x	4.8
TSP	negligible

5. AGRICULTURAL EQUIPMENT

The basic source for much of the data developed for this category is the 1974 Oklahoma Census of Agriculture. Using historical trends, all data were linearly projected to the base year as well as the projection years.

For each type of fuel-consuming machine, the number in use in each county was estimated. Combining this number with the average gallons per year consumption figure from The EPA Procedures document, an estimate of total number of gallons used for both gasoline and diesel types was made. Table II-13 shows the type of fuel used by each type of machinery inventoried.

For each county other than Tulsa, totals had to be adjusted to account for the portions of the county not included in the study area. The factors used were estimated from a U.S. Census map showing land in farms for the State of Oklahoma. The estimated percentages of county farmland within the inventory area are: Osage Co, 30%; Okmulgee Co, 50%; Creek Co, 30%; and Washington Co, 40%.

Projections

Emissions from agricultural equipment were assumed to be proportional to the area of harvested cropland. Projection figures were calculated by extrapolating county trends from 1969 to 1974. Also factored into the projections was state data from 1964 to 1974. Both trends were equally weighted in projecting harvested cropland. Table II-14 shows the resulting growth factors by county.

Emission Factors

Emission factors were broken down by type of machinery. Table II-15 shows all factors used, which were taken directly from AP-42. For purposes of input to the emission factor file, a weighted average emission factor was calculated between the tractor and non-tractor classifications for both diesel and gasoline categories.

Allocation

All emissions were allocated to subcounty grids by harvested cropland. For those areas within TMAPC's traffic zones, data were provided through the PLUM model output. These data were acquired for all three inventory years.

TABLE II-13

FARM MACHINERY USAGE DATA

TYPE OF MACHINERY	ANNUAL USE (hr/yr)	DIESEL FUEL (%)	GASOLINE (%)
Tractors	*	65	30**
Combines	71	43	57
Balers	24		100
Harvesters	120	100	
General Purpose	50	50	50

* 490 hr/yr diesel, 291 hr/yr gasoline
** About 5% is liquid petroleum gas.
Source: EPA-450/2-77-028

TABLE II-14

HARVESTED CROPLAND GROWTH FACTORS

COUNTY	1977 TO 1982 GROWTH FACTOR	1977 TO 1987 GROWTH FACTOR
Osage	0.943	0.858
Washington	1.061	1.105
Okmulgee	0.980	0.942
Creek	1.000	0.990
Tulsa*	1.081	1.048

* Source was PLUM model output from TMAPC.

TABLE II-15

AGRICULTURAL EQUIPMENT EMISSION FACTORS

POLLUTANT	Emission Factors lb/1000 gallons fuel GASOLINE TRACTOR	 GASOLINE NON-TRACTOR	 DIESEL TRACTOR	 DIESEL NON-TRACTOR
CO	3260	4100	119	139
Exhaust VOC	125	135	60.7	57.1
Crankcase VOC	25.1	27.1	-	-
Evaporative VOC*	34.4	3.53	-	-
NO_x	151	98.5	335	307
Aldehydes	6.84	4.14	12.1	10.2
SO_x	5.31	5.28	31.2	31.1
Particulates	8.00	6.86	45.7	51.3

* Units expressed as lbs/unit-year.

For the sections of the inventory area outside the traffic zones, an estimate of the amount of farmland in each grid was made by utilizing the U.S. Geological Survey quadrangle maps.

6. CONSTRUCTION EQUIPMENT

Emissions from construction equipment were divided into three subcategories: residential construction, commercial and industrial construction, and highway construction and repair projects. Each was analyzed independently. Emissions were assumed to be proportional to project value.

The county activity parameters (gallons of fuel consumed) were found from apportioning state off-highway fuel consumption to each county. From Energy Data Reports, a publication of the U.S. Department of Energy, it was estimated that 2,219,000 barrels of diesel oil was sold in Oklahoma in 1977 for use in construction equipment and agricultural equipment. State figures from the Oklahoma Census of Agriculture indicate that about 43% of this total went for agricultural use, leaving 57%, 53 million gallons, for statewide construction equipment fuel use. Each county's portion was assumed to be proportional to its statewide share of heavy construction contractor employees (SIC 16). This data was taken from County Business Patterns 1976, published by the U.S. Bureau of the Census.

Once county diesel fuel use for construction equipment was estimated, it was assumed that gasoline use for this category was 10% of the diesel use figure. This agrees with national figures found in Procedures for the Preparation of Emission Inventories for Volatile Organic Compounds.

Projections

OBERS projections provided future-year data for employment and dollar earnings from contract construction. This data was cross-checked with historical trends in single and multiple-family dwelling units, building permits issued, and building contracts and highway contracts. The data shows that although construction within the city of Tulsa has generally been declining in the 1970's, (especially dwelling unit construction), the opposite is true for Tulsa County and the study area in general. The growth factors that were used reflect the OBERS projections. They are: 1) an increase of 22.9% from 1977 to 1982; and 2) an increase of 46.3% from 1977 to 1987.

These figures are also consistent with those obtained from the Oklahoma State Department of Health.

Emission Factors

The source of information for emission factor calculation was AP-42. Each of the ten major types of heavy-duty construction equipment was analyzed. The annual operation in hours per year for each piece of equipment was used to produce a composite emission factor. For example, according to AP-42 scrapers operate 2000 hours per year, while motor graders operate only 830 hours per year. The set of emission factors for scrapers was therefore weighed about 2.4 times more in the calculation of the overall emission factor. This procedure was done for both diesel powered equipment and gasoline users, so that two composite factors were found. These are shown in Table II-16. The VOC emission factors for gasoline equipment include both evaporative and exhaust sources.

Allocation

Construction equipment emissions were allocated to grids by location and project value. Specific locations of residential construction, commercial and industrial construction sites, and highway projects were found from Business Highlights magazine, as were project values. This source, which is the official publication of the Metropolitan Tulsa Chamber of Commerce, (MTCC), contains data for Broken Arrow and other areas within the inventory area.

A. Residential Construction

Since 77% of the residential construction in the Tulsa SMSA (six-county area) is located in Tulsa and Broken Arrow, it was assumed that 90% of the residential construction in the inventory area takes place there. The total value of residential construction for Tulsa County in 1977 was estimated by Elaine Barton, of MTCC, as $189 million. Most of this figure was allocated to grids in the cities of Tulsa and Broken Arrow. Other locations included northern Tulsa Co. (near the site of the Cherokee Industrial District), the Owasso periphery, and the Skiatook periphery. To a lesser extent, some grids were included near the towns of Collinsville, Sperry, and Okmulgee, where residential construction was assumed to occur. Grids were classified either as major sites of residential construction ($830 thousand dollars per grid), or minor sites ($350 thousand per grid).

TABLE II-16

CONSTRUCTION EQUIPMENT EMISSION FACTORS

POLLUTANT	GASOLINE EQUIPMENT ($lb/10^3$ gallons)	DIESEL EQUIPMENT ($lb/10^4$ gallons)
Carbon Monoxide	3766	895.8
VOC	51.6	366.2
Nitrogen Oxides	108.7	4222
Sulfur Oxides	5.28	312
Particulates	7.10	239

B. Commercial and Industrial Construction

Copies of Business Highlights from the first three quarters of 1977 were analyzed for project value as well as location. In the "Construction Scoreboard" section of each issue, a detailed summary provides this information for the following categories: Manufacturing/Industrial/Warehouse, Retail/Commercial, and Miscellaneous. Only projects which started construction before the fourth quarter of 1977 were considered. Allocations were made by matching project value and the given addresses to grids.

C. Highway Construction Projects

A list of the major highway projects that were ongoing during 1977 in the Tulsa area was obtained from the Oklahoma Department of Transportation. The data that were provided included the overall project value, the location of the project, the type of work involved, and the estimated period of construction. The project value figure was calculated by dividing the total project value by the number of years of project duration. In this manner, only the project amount expended in 1977 was considered.

7. SMALL GASOLINE ENGINES

Information contained in AP-42 indicates that 89% of small gasoline engines are used in lawn and garden equipment. There are two types of engines available for this purpose: two-stroke and four-stroke. A call to a local dealer revealed that over 80% of the lawn and garden equipment sold today is four-stroke. This is primarily because they are less expensive.

Table II-17 shows the approximate breakdown of small engines by use, and also their approximate annual fuel consumption from AP-42.

Using the information from the above table, the weighted average gallon per unit-year, 12.7 gallons, was found. In order to account for meteorological differences between Tulsa and other parts of the nation, a temperature correction was applied to this figure. From Procedures, the average number of days in the year when the minimum temperature is greater than 32°F in the study area should be divided by the same figure for the national average. For Tulsa, this factor becomes 285/250. When applied to the 12.7 gallons per unit-year, the resulting figure is now 14.5 gallons per unit-year.

TABLE II-17

SMALL GASOLINE ENGINE DATA

TYPE	PERCENT IN USE	AVERAGE ANNUAL FUEL USE
Four-stroke miscellaneous	11	12.3 gal/unit
Two-stroke lawn and garden	15	20.6
Four-stroke lawn and garden	74	10.8

From AP-42, there are about 0.21 units per person nationwide. Therefore:

14.5 gal/unit x 0.21 units/person = 3.0 gallons/capita/yr

Projections

Fuel usage for this category was projected according to population figures provided in the introduction to this chapter.

Emission Factors

A weighted average according to fuel use of the three types of engines was calculated. The results are shown below in Table II-18.

TABLE II-18

SMALL GASOLINE ENGINES EMISSION FACTORS

SO_x	TSP	CO	HC	NO_x	UNITS
5.14	10.4	3792	448	41.9	$lb/10^3$ gallons

Allocation

All emissions from this category were allocated by dwelling units. This was done separately for 1977, 1982, and 1987, as outlined in the introduction to this chapter.

8. GASOLINE HANDLING

Although data from the Oklahoma Tax Commission indicated that about 260 million gallons of gasoline were sold in Tulsa County in 1977, local officials indicated that this figure was too low. The Tulsa City-County Health Department used a figure of 309 million gallons for their State Implementation Plan. This figure was based on an estimate by the Oklahoma Marketers Association. ES confirmed the 309 million figure with data from Sun Oil Company's bulk terminal, which provides about 80 percent of the gasoline sold in Tulsa County. There are no bulk plants in the Tulsa study area.

For the other counties in the inventory area, and also the cities of Bartlesville and Muskogee, gas sales were estimated using VMT figures. One gallon of gasoline was assumed to be sold for every 14 vehicle miles travelled, as recommended by TCCHD.

Projections

An annual increase of 4.4% per year was assumed for both the 1982 inventory and the 1987 inventory. This figure was recommended by the Oklahoma Employment Security Commission and also by the U.S. Bureau of Economic Analysis (U.S. Census). The figure of 4.4% per year was also used by the Tulsa City-County Health Department for their State Implementation Plan.

Emission Factors

Data from the survey taken by TCCHD indicates that 15.5% of service station tanks do not have submerged fill drop tubes. From AP-42, the emission factor for submerged fill is about 18 pounds of VOC vapor per thousand gallons, whereas splash fill has a factor of 22.4 pounds per thousand gallons. For the Tulsa area, therefore, a factor of 18.7 pounds per thousand gallons, a weighted average was used.

No other type of pollutant besides VOC are emitted in this process. Also, it should be noted that these factors included the filling of the underground tank, spillage, underground tank breathing, and vehicle refueling.

Allocation

For Tulsa County, by far the area containing the most emissions for this category, allocation was accomplished by service station location. This was made possible by the survey done by TCCHD. Since the data were available only in square-mile grids, a computer program (AQZTOGR) was applied to transform the data to the two-kilometer OCS grids.

For the other counties within the inventory area, allocation was made by commercial employment.

9. DRY CLEANING

TCCHD conducted a dry cleaning establishment survey in Tulsa County for calendar year 1977. The questionnaires, which achieved a 90% response, were used to calculate pounds of emissions (see Appendix D, Item 10). Two types of operations were considered: typical and controlled. The vast majority of operations were typical (uncontrolled).

For the other counties in the inventory area, dry cleaning emissions were estimated from Tulsa's figure using total employment ratios.

Projections

All projections for the 1982 and 1987 inventories were based on population.

Emission Factors

As previously indicated, the emission factors incorporated into the activity parameter were taken from AP-42 supplement 7, as developed by TCCHD.

Allocation

Since detailed location data were available for Tulsa County, allocations were made by individual grid locations of dry cleaning establishments. The information was translated from square-mile grids to OCS grids using AQZIOGR computerized transformation equations (see Chapter 2, Introduction).

In those areas outside Tulsa County, dry cleaning emissions were allocated according to commercial employment.

10. DEGREASING, SURFACE COATING, AND MISCELLANEOUS COMMERCIAL/CONSUMER SOLVENT USE

These three categories were combined on the area source NEDS form. Their total figures appear in the evaporation category under "Solvent Purchased".

Using data acquired from TCCHD, it was determined that 4.0 pounds per capita emissions were attributable to liquid cold cleaning (degreasing). This figure was based on a national average.

Trade paint, as defined by the National Paint and Coating Association, refers to paint, enamel, varnish, etc., used by individuals and contractors for exterior and interior surface coating. A figure of 2.1 gallons per capita was recommended by the Association. Also, 2.0 gallons per capita is the figure used by the U.S. Census of Manufacturers. Assuming a density of about 10.0 pounds per gallon for both solvent based and water based paint, this produces a figure of about 20 pounds per capita of paint use. Using a 17.5% volatility factor from Procedures, an emissions total of about 3.5 pounds per capita can be used for trade paint.

Detailed information concerning solvent usage is presented in End Uses of Solvents Containing Volatile Organic Compound, (EPA 450/3-79-032) published by The Research Corporation of New England. In Part III, "Application to Emission Inventories", a miscellaneous commercial/consumer solvent use figure of

10 pounds per capita, excluding surface coating and degreasing, was recommended. This information was based on a detailed national balance of nationwide solvent use in the U.S.

Combining the per capita emissions totals from all three components of this category, a total of 17.5 pounds per capita emissions can be assumed for the entire category of miscellaneous solvent use. Some industrial degreasing, especially vapor degreasing, is dealt with in the point source inventory. Also, 5.5 tons of emissions were added to grid 790290 for the base year inventory, due to a highway bridge-painting project on the Arkansas River in 1977.

Projections

The Oklahoma State Department of Health projected degreasing to increase 5.6% per year until 1982. This figure was extended to 1987 for purposes of this inventory. For architectural coating and other solvent use, projections were based on total employment figures.

Emission Factors

The factor used for this category was 2000 pounds per ton. The assumption made for the degreasing category was that all the solvent used evaporates. For surface coating, the 17.5% volatility factor was incorporated into the activity parameter. Due to the evaporative nature of this category, no other pollutant is emitted other than the various splits of volatile organic compounds.

Allocation

All allocations for this category were made to total employment.

11. CUTBACK ASPHALT PAVING

Data supplied by the Tulsa County Engineer's office shows that a total of five companies reported using cutback asphalt for 1977 in Tulsa County. Their total gallon usage of cutback is as follows:

1.	Anchor-Amulco	522,215
2.	Standard Industries	192,970
3.	Tulsa Rock Co.	183,000
4.	Cummins Construction Co.	25,316
5.	Monarch Asphalt	7,500

Hydrocarbon emissions were calculated using the following assumptions: 1) the density of cutback asphalt in Tulsa County is 7.82 pounds per gallon; 2) the fraction of diluent (VOC) in the cutback averages 35% by volume and 3) the percentage of diluent to evaporate averages 25% for slow cure, 70% for medium cure, and 80% for rapid cure. Of the 931,000 gallon total, 893,000 gallons were classified by the Tulsa County Engineer as medium cure. Emissions were based on factors obtained from EPA 450/2-77-037, Control of VOC from the Use of Cutback Asphalt. The total VOC emission figure for Tulsa Co. was extrapolated to other inventoried areas using total VMT ratios.

Projections

The use of cutback asphalt is expected to decrease in Tulsa County over the next several years. The Tulsa County Highway Department is moving to emulsified asphalt for chip sealing in order to comply with State Regulation No. 15, "Control of Emissions of Organic Materials". Approximately 893,000 gallons of medium cure cutback was used in 1977 (96% of the total). Yet, only 510,000 gallons were projected for 1978.

The Tulsa City-County Health Department has projected 1982 figures at 58% less than the base year. This number was used for input to the Oklahoma State Implementation Plan (SIP) and was also used for this study. Data from officials at TCCHD indicates that by 1987 the emissions from this category can be considered negligible. For the process called seal coating (chip seal), cationic emulsified asphalts can be used in place of cutback asphalt. This is the major use of cutback asphalt in Tulsa County. However, for the penetration coat operation, no substitute can be used. This operation, according to the County Engineer's office, involves the use of cutback asphalt in penetration of subgrade or rock base for asphaltic concrete overlay. Only a small amount is necessary to form the required moisture seal, so usage is estimated at less than 20,000 gallons per year. Extrapolating the use of this to 1987 (using an annual VMT growth rate of 2.5%):

20,000 gallons x 7.82 lbs/gal x .298 (fraction of diluent by weight)
x 0.70 (medium cure evaporation) x 1.28 (10-yr growth factor)
= 21 tons/yr emissions

This figure was used for the Tulsa County 1987 inventory.

The growth factor of 2.5 percent per year was also for the outlying counties in the study area. Since emission totals are very low for these areas, no effort to decrease the amount of cutback asphalt used can be expected.

Emission Factors

The emission factors were included in the county activity parameter for this category. All factors were based on EPA-450/2-77-037, Control of VOC from the Use of Cutback Asphalt.

Allocation

For all areas other than Tulsa County, emissions for this source category were allocated by vehicle miles travelled on rural and urban roads. Limited access roads were not included. For Tulsa County, such data were not readily available in gridded form, so emissions were allocated to population.

12. PESTICIDES APPLICATIONS

From telephone conversations with Jerry Legg of the Oklahoma State Department of Agriculture, an estimate of the types and amounts of pesticides used in the study area was made.

Three pesticides are the most common. They are Lannate (chemical name methomyl); Sevin (carbaryl); and 2,4-D. Methomyl and carbaryl are insecticides; 2,4-D can be used as either an insecticide or a herbicide. Also mentioned was weed oil, which, as defined in Procedures (EPA-450/2-77-028), is unburned motor oil and/or petroleum distillates such as diesel fuels. Weed oil can be considered a general herbicide.

Table II-19 shows the estimated amounts of each pesticide used in Tulsa County for 1977 and is based on the assumption that the density of the liquid pesticides is 7.8 pounds per gallon.

Table II-20 was made from the analysis of a typical insecticide, provided by Capital, Inc. Since pesticide data available from the other counties in the study area was minimal, the data from Tulsa County was extrapolated to other counties by the amount of farm acreage in each.

Projections

From conversations with the Oklahoma State Department of Agriculture, it was estimated that a growth factor of 10% per year would not be unreasonable. However, information from the Tulsa County agricultural extension office did

TABLE II-19

ESTIMATED PESTICIDE USE IN TULSA COUNTY FOR 1977

Methomyl	4,000 lbs
Carbaryl	8,600 lbs
2,4-D	5,780 lbs
Weed Oil	18,300 lbs
Other pesticides	18,300 lbs

TABLE II-20

TYPICAL INSECTICIDE COMPONENT FRACTIONS

Petroleum distillate	83.75%
Essential oils	0.25
O-Iso-isprotoxy phenol	1.0
Inactive ingredients	15.0

not support this projection. Rather, it forecast that the annual growth factor would be 1 or 2% as an absolute maximum. To resolve this, historical data was reviewed from the Oklahoma Census of Agriculture. For Tulsa County, insecticide use increased about 11% in the five year period from 1969 to 1974, while herbicide increased 18%. The figures were slightly less for Okmulgee County but much more for Osage County. Given the wide range of information, it was decided to use an annual growth factor of 4% for all counties except Osage. Here the annual growth factor was estimated to be 7%.

Emission Factors

The criteria from Procedures were applied to the active/inert components from Table II-20. That is, 90% of the active ingredients were assumed to be volatile, as was 10% of the inert ingredients. This resulted in a combined emission factor of 0.78 pounds per pound of pesticide.

Allocation

Emissions for this category were allocated to farmland acreage separately for 1977, 1982, and 1987.

13. OIL WELLS AND GAS WELLS

The Oklahoma Corporation Commission supplied data concerning total gas and oil production in Tulsa County. Besides conventional oil production, there are various forms of secondary oil recovery. This involves injecting the wells with other liquids in order to extract additional oil. TCCHD, in their April 1979 area source emissions inventory report (Appendix D, Item 3), presented emissions data for both natural gas production and the various forms of oil recovery. These figures were used for input to the Oklahoma SIP; they were also used in this study.

The county activity parameter used for this category was number of oil or gas wells. The county figures obtained from the Oklahoma Corporation Commission were multiplied by the estimated percentages of wells within the study area portion of the county. Table II-21 shows these percentages and the resulting estimates of number of wells.

Projections

Data from the Corporation Commission and from local officials at TCCHD indicate that the best estimate of oil and gas production projections would

TABLE II-21

NUMBER OF OIL WELLS AND GAS WELLS IN THE TULSA STUDY AREA

	1977 TOTAL WELLS			TOTAL IN STUDY AREA	
COUNTY	OIL	GAS	% IN STUDY AREA	OIL	GAS
Tulsa	1382	9	100	1382	9
Okmulgee	1985	187	55	1092	103
Osage	8394	31	26	2186	8
Washington	3043	2	50	1522	1
Creek	4955	61	40	1982	24
Bartlesville (city & vicinity)	100	0	100	100	0

Source: Oklahoma Corporation Commission.

be to assume no growth to 1982 and a slight increase for the 1987 estimate. By 1987, more methods of extraction will become economically feasible due to skyrocketing energy costs. However, no new oil or gas fields have been discovered in the study area, with the exception of Osage County where three new fields will soon become available for oil production. Therefore, emissions for 1982 were the same as base year, while 1987 was projected at a figure 5% higher than 1977. For Osage County, a continuous increase of 3% per year will be used, as recommended by TCCHD.

Emission Factors

The emission factors used for this category were: 4,760 pounds per gas well per year, and 267.6 pounds per oil well per year. These factors were derived from EPA 450/3-78-004, which recommended the factors 40 pounds per thousand barrels of oil for standard production, 7.7 pounds per thousand barrels for secondary oil recovery (water injection), and 175 pounds per million cubic feet of gas.

Allocation

The number of oil and gas wells in each grid were determined from U.S.G.S. quadrangle maps. Due to the stable nature of gas and oil field location, projection year allocation was kept the same as that for the base year.

14. ON-SITE INCINERATION

An incinerator survey was conducted by TCCHD. Results indicated that there were 25 incinerators operating during calendar year 1977 which burned a total of 5,749 tons of refuse. The survey included banks, schools, hospitals, food stores, and other businesses. The data from the other counties indicated that no incinerators were in use, even in the more urban areas such as the city of Okmulgee. However, calls to the county health departments in Bartlesville and Muskogee revealed that some local groceries and hospitals did have incinerators in use. Since tonnage burned was unavailable, typical values of 200 tons per year for a grocery store and 50 tons burned per year for a hospital were used. These figures were averaged from the TCCHD Report in Appendix D, Item 9.

Projections

Since 1977, two incinerators in Tulsa County have been shut down. According to officials at TCCHD, the trend of one less incinerator per year should continue. The suggested growth factors were 0.75 for 1977-1982 and 0.60 for 1977 to 1987. These factors were also applied to the few incinerators located outside Tulsa County.

Emission Factors

All emission factors were taken directly from AP-42. They are expressed as pounds per ton of refuse burned: Particulate - 7.0, SO_x - 2.5, CO - 10, VOC - 3.0, and NO_x - 3.0.

Allocation

Allocation was performed separately for each inventory year by grid location of each incinerator.

15. OPEN BURNING

The category of open burning is characterized by higher emissions in the more rural areas and very low emissions in urban areas. This is due to the prevalences of city ordinances against open burning, as well as routine trash collection services.

In order to estimate open burning emissions for the rural portions of the inventory, refuse production must be estimated. Data from Tulsa City-County Health Department indicates that an average of 11.7 pounds refuse/dwelling unit/day is produced. This results in about 1,640 pounds of trash/person/year. Considering that 60% is burned (according to TCCHD), a figure of 985 pounds/person/year can be attributed to the residential open burning category for rural Tulsa County. This figure also used to estimate the contribution of open burning to non-Tulsa County rural areas in the study area.

For metropolitan Tulsa, TCCHD recommended a figure corresponding to 2.9 pounds/person/year.

Projections

Estimates from TCCHD indicate that open burning will decrease at the rate of 3% per year, due to stricter enforcement of existing regulations. For the other counties in the study area, it was assumed that the amount of open burning will vary according to population.

Emission Factors

AP-42's "Emission Factors for Open Burning of Nonagricultural Material" was used for this category. Table II-22 lists these factors.

TABLE II-22

OPEN BURNING EMISSION FACTORS

Particulates	16 pounds per ton refuse burned
Sulfur Oxides	1 pound per ton
Carbon Monoxide	85 pounds per ton
Organics	30 pounds per ton
Nitrogen Oxides	6 pounds per ton

Allocation

The allocation factors developed for open burning reflect the difference between rural and urban areas. The data from TCCHD were hand allocated to grids on the basis of their population. This procedure was followed for the other counties, also. In general, residences in rural areas contribute more emissions for this category than urban residences.

16. NATURAL GAS USE

Natural Gas is the only significant fuel used for heating in the Tulsa inventory area. The Tulsa City Building Inspector and the city boiler inspector indicate that there is no coal use in the area.

The Oklahoma Natural Gas Company supplied 1977 figures for natural gas usage into separate categories of residential, commercial, and industrial use. The area represented by these figures was the Tulsa AQMA, which encompasses all of Tulsa County and other sections to the east and west. From population totals, it was assumed that 90% of the AQMA residential fuel use was in Tulsa County. Residential fuel totals for other areas were based on Tulsa Co. data using dwelling unit ratios.

From employment figures, it was estimated that 92% of the AQMA commercial natural gas usage could be attributed to Tulsa County, whereas 99% of the industrial usage was apportioned in the same manner.

Commercial employment ratios were used to extrapolate the Tulsa County commercial natural gas use figures to other portions of the study area. Also, it was determined that all industrial natural gas use was accounted for in the point sources for the following areas: Creek County, Osage County, Bartlesville, and Washington County. For Tulsa County, the total of 53,550 MMcf was reduced by the 30,326 MMcf accounted for in the point sources. Likewise, Okmulgee County was reduced from 1,460 MMcf to 1,400. The city of Muskogee retained all of its industrial 4,020 MMcf in the area source inventory.

Projections

Residential natural gas usage was projected according to population. Commercial use was projected according to commercial employment. That portion of industrial natural gas usage in the area source inventory was projected by manufacturing earnings according to OBERS data. This resulted in a factor of 1.220 for the 1977-1982 period and 1.446 for the period 1977-1987.

Emission Factors

All emission factors were taken from AP-42. They are shown in Table II-23. For the industrial category, the lower figure from AP-42 was used in the range given for NO_x emission factors. This is because the larger boilers (with greater emission rates) were accounted for in the point source inventory.

Allocation

Residential natural gas use was allocated according to the number of dwelling units, whereas commercial usage was allocated proportionally to commercial employment. For area source industrial gas usage, allocation was made to total employment. ES developed separate sets of allocation data for the base year and each projection year.

17. FOREST FIRES

Although local officials in Northeastern Oklahoma do not refer to their open land as "forest", there does exist timberland in the area that can be destroyed by fire. Kyle Good of the Osage County Agricultural Stabilization and Conservation Office estimates that 10,000 acres of timberland was destroyed in Osage County in 1977. Although about 22% of the county acreage lies within the study area, it was estimated from U.S.G.S. quadrangle maps that only 2.5% of the burned acreage was located inside the inventory area, since most of Osage's timberland lies in the northern and western sections of the county.

The only other county reporting forest fires was Creek County. Most fire calls in eastern Creek (study area) are answered by the Bristow Fire Department. Officals there estimate that there were 24 timber fires in 1977, and that the average acreage burned was about 25. Since the town of Bristow is actually located outside the study area, it was estimated that about 40% of the timber fires could be allocated to areas within our inventory boundary.

From the above information, it can be calculated that Osage County was attributed 250 acres of forest fires and Creek County 240 acres. From AP-42, it was estimated that nine tons of timber were burned per acre.

Projections

Since counties other than Osage or Creek have little or no "forest", they will be assumed to remain at zero for this category. Because no development is expected in the wooded acres of Osage and Creek Counties, the same

TABLE II-23

NATURAL GAS EMISSION FACTORS

POLLUTANT	EMISSION FACTORS, lb/MMcf RESIDENTIAL	 COMMERCIAL	 INDUSTRIAL
Particulates	10	10	10
Sulfur Oxides	0.6	0.6	0.6
Carbon Monoxide	20	20	17
Hydrocarbons	8.0	8.0	3.0
Nitrogen Oxides	80	120	120

figures will be assumed for the projection years as those determined for the base year.

Emission Factors

Table II-24 shows emission factors which were obtained directly from AP-42.

Allocations

Allocation was made as shown on U.S.G.S. quadrangle maps to those grids of Osage and Creek Counties which contained timberland. An allocation value of two was assigned to grids with wooded acres in known areas of forest fires. A value of one was assigned to wooded areas bordering forest fire locations.

18. AGRICULTURAL BURNING

This category includes two types of field burning: 1) accidental grass or field fires which cannot be classified as forest fires; and 2) the premeditated burning of fields for clearing purposes. A good example of the first type occurred in Okmulgee County. According to Don Robinson, county agricultural agent, a large fire consumed 400 acres of grassland northern Okmulgee County in July 1977. Other instances of smaller grass fires were reported in Washington County and rural Tulsa County.

From AP-42, a value of three tons of growth per acre was used. This corresponds to the "unspecified weeds" loading factor value. It also is the median value for wheat and corn burning, as well as corresponding to other field crops.

All data concerning the two types of field burning was acquired through telephone conversations with agricultural extension agents or fire departments.

Projections

The nature of wildfires defies projection. Since purposeful field burning is expected to generally remain the same, the 1982 and 1987 inventories contain the same figures as the base year.

Emission Factors

The emission factors for this category were taken from AP-42. An average was calculated from two categories, Grasses and Unspecified Weeds. They are listed in Table II-25.

TABLE II-24

FOREST FIRE EMISSION FACTORS

Particulates	17 lb/ton
Carbon Monoxide	140
Hydrocarbons	24
Nitrogen Oxides	4
Sulfur Oxides	Negligible

TABLE II-25

AGRICULTURAL BURNING EMISSION FACTORS

POLLUTANT	GRASSES	UNSPECIFIED WEEDS	FACTORS USED
Particulate	16	15	16 lb/ton
Carbon Monoxide	101	85	93 lb/ton
Organics	19	12	16 lb/ton

Allocation

Emissions were allocated to individual grids by their amount of farmland in acres, since this parameter best reflects the rural nature of the category.

19. STRUCTURAL FIRES

Structural fire data in Tulsa County was available from the City of Tulsa Fire Department Report for calendar year 1977. The data from the city was extrapolated to the county level on the basis of dwelling units. Those structures counted in the report include the following, which are listed in order by the number of fire alarms attributed to them: residential, mercantile, manufacturing, storage, institutional, hotel or motel, theater, and lumber yard.

For areas outside Tulsa County, the national average of four fires per 1,000 population was used. This figure was taken from EPA-450/2-77-028, Procedures, Volume 1.

Projections

The number of structural fires was projected according to dwelling units for both 1982 and 1987 inventories.

Emission Factors

An average 1,500 square foot dwelling contains 16.8 tons of wood. To this estimate, four tons of furnishings can be added. Since 1,844 of the 2,170 structural fires in Tulsa County were residential in nature, the 20.8 tons of wood burned per fire was incorporated into the emission factor (pounds per fire). They are shown in Table II-26.

Allocation

The emissions from this category were allocated to grids according to the dwelling units distribution for each inventory year.

20. NATURAL GAS LEAKS

Information obtained from the Oklahoma Natural Gas Company indicated that leakage amounts to 1.15% of all delivered gas. This leakage occurs at the fittings or in the instrumentation.

In order to quantify the leakage for estimating emissions, the amount leaked was converted to weight using the density of natural gas (0.042 pounds

TABLE II-26

STRUCTURAL FIRE EMISSION FACTORS

POLLUTANT	AP-42 VALUE	EMISSION FACTOR
Particulate	14 lb/ton	353.6 lbs/fire
Sulfur Oxides	NEGLIGIBLE	
Hydrocarbons	4 lb/ton	83.2 lbs/fire
Carbon Monoxide	50 lb/ton	1,040 lbs/fire
Nitrogen Oxides	2 lb/ton	41.6 lbs/fire

per cubic foot at ambient temperature and pressure), and then multiplied by the percentage by weight of the volatile organic compounds in the gas. Substances such as nitrogen gas, carbon dioxide, and methane were assumed to be non-reactive and were not considered in the calculations. A gas chromatographic analysis, done by Pantechs Laboratories of Pampa, Texas, was supplied to ES by the Oklahoma Natural Gas Company. This analysis is shown in Table II-27.

Projections

Gas company officials have been making efforts to discover and seal existing leaks. Although leak reduction has yet to be quantified, it appears that the trend is toward fewer leaks. As energy costs increase, finding leaks will become more cost-effective. Therefore, it was estimated that 1982 leaks will be 20% lower than that for the base year, and the 1987 inventory will be reduced a total of 50%. These reductions were offset by increased natural gas use, which was assumed to occur in proportion to population.

Emission Factors

Due to the nature of the initial calculations the emission factor used was 100 pounds VOC per 100 pounds of natural gas. This is because only the volatile components were considered in the activity parameter calculations.

As evidenced by the chromatographic analysis, no other pollutant besides VOC can be considered significant.

Allocation

Natural gas leakage was allocated to subcounty units by population for each of the inventory years.

21. OILY WASTE DISPOSAL

Oily waste disposal, or soil farming, is a method of disposal for oily waste from refinery processes. The waste, which is mostly heavy crude oil, water, and dirt, is unloaded into retention ponds and allowed to settle. The oil component is skimmed off the top and transferred to storage tanks where it is allowed to settle again. The major operator in the area, Wade Farnum, spreads the sludges over a 113 acre area. The spreading is rotated on a total area of 240 acres.

TABLE II-27

CHROMATOGRAPHIC ANALYSIS OF NATURAL GAS IN THE TULSA AREA

COMPONENT	MOL %	REACTIVITY
Nitrogen	1.92	NO
Carbon Dioxide	0.71	NO
Methane	91.41	NO
Ethane	4.45	NO
Propane	0.98	YES
-Butane	0.11	YES
N-Butane	0.25	YES
I-Pentane	0.06	YES
N-Pentane	0.06	YES
Hexanes +	0.05	YES
H_2S	NIL	-

Other types of waste which are soil farmed to a lesser extent include tetraethyl lead sludge and other leaded sludges, bio-sludge, and tank bottom sludge. Each involves some type of VOC emissions during the evaporative process.

Table II-28 gives the locations and extent of all soil farming in the inventory area.

Projections

Although Farnum's operation will cease in 1979, it is expected to be taken over by Sun Oil Co. Local officials at TCCHD have suggested that future year inventories retain the same amounts of oil sludge farmed as the base year. Therefore, the 1982 and 1987 inventories will remain the same as the base year for this category.

Emission Factors

Two assumptions were made in the calculation of the emission factor. First, the oil in question is very heavy, therefore, a figure of 8.0 pounds per gallon was assumed. Second, as per TCCHD, a 3% annual oil evaporation rate was assumed.

Therefore:

8 lb/gal = 336 lb/barrel = 33,600 lbs/100 barrels

33,600 x 0.03 = 1,008 lbs emissions/100 barrels

This factor was rounded to 1,000 lbs/100 barrels.

Allocation

As identified in Table II-28, allocations were made to specific grid location of the soil farm sites. All sites are located in either Creek County or Tulsa County, while the great majority of emissions come from Creek County.

TABLE II-28

SOIL FARMING DATA IN THE TULSA INVENTORY AREA

WASTE	GRID LOCATION	AREA FARMED	BBLS/YR	% OIL CONTENT
Oil Sludge (soil)	774,286	113 acres	260,975	50
Oily Sludge (pour)	774,286	3.67 acres	104,025	50
Bio-Sludge	780,310	5.5 acres	52,000	0.26
Tetraethyl lead sludge	780,310	-	48	25
Tank Bottom Sludge	780,310	20 acres	13,095	35
Oily Sludge	778,312	0.1 acres	6	25
Leaded Sludge	778,312	2.8 acres	104,025	50

Source: TCCHD report (Appendix D, Item 7).

CHAPTER III

ANNUALIZED POINT SOURCE INVENTORIES

INTRODUCTION

The original approach upon which the study was based depended upon the use of existing emission inventories to the fullest possible extent. The refinement of existing emission inventory data concentrated on sources of volatile organic compounds or nitrogen oxides within the 6,200 square kilometer study area that had actual emissions greater than 25 tons per year. Data for other pollutants and all other sources within the Northeast Oklahoma Air Quality Control Region were in most cases accepted as originally provided by the respective agency. In addition, ES only addressed inventory parameters that were thought to be essential for the photochemical oxidant modeling effort. These parameters included: stack location; actual stack emissions; percent annual throughput; normal hours per day, days per week, and weeks per year of operation; stack emission characteristics (for stacks to be modeled as elevated points); estimated control efficiency; Source Classification Code; and operating rate. Although ES developed inventories for 1977, 1982, and 1987, most of the effort was placed in the base year inventory. The 1977 inventory was considered the most important for three reasons. First, it was to be used for the model validation effort. Second, it represented historic data and thus was the most accurate available. Third, accurate growth projection could only follow from an accurate assessment of base year conditions.

In the sections that follow, base year inventory development and subsequently projection year inventory development are discussed. For the base year, the documentation is arranged chronologically in accordance with inventory development. For the projections, the treatment of general growth is first discussed followed by source or plant specific growth. Power plants, refineries, and storage tanks are the most significant VOC and NO_x emitters in the inventory area and as such are singled-out in the remainder of this chapter. Tables III-8 through III-10, which summarize base and projection year emissions for the plants in the AQCR, clearly show the predominance of these three types of emitters.

BASE YEAR INVENTORY DEVELOPMENT

Existing Inventories

After investigating the available emission inventory data, ES determined that the 1976 Oklahoma State Department of Health (OSDH) inventory was most suitable for use in this study. At first, ES considered using the existing inventory data base for Oklahoma available in the National Emissions Data System (NEDS). However, both OSDH and EPA Region VI personnel indicated that the NEDS information was not reliable, as the preliminary ES review suggested, because some annual updates had been performed out of sequence. An additional factor leading to the choice of the 1976 OSDH master file was that the Tulsa City-County Health Department develops annual updates using the OSDH file as a base. Such updates for 1977 would be used by ES to develop a preliminary 1977 master file for Tulsa County.

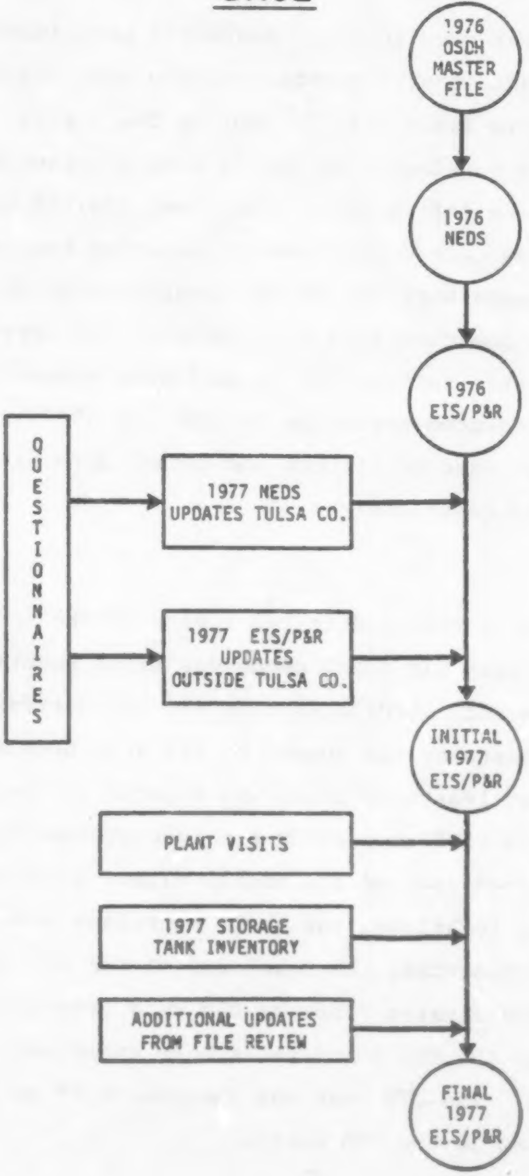
A flow diagram identifying the steps taken to generate the final 1977 EIS/P&R master file is shown in Figure III-1. Because the OSDH master file format differed slightly from NEDS, ES developed a short computer program to transform the file to the NEDS format. The resulting NEDS file for 1976 was then converted to EIS/P&R format using a standard routine built into the Engineering-Science Air Quality (ESAQ) system. The resulting EIS/P&R file did not contain emission factors since emission factors are not included in NEDS inventory data. Therefore, ES could not easily verify that appropriate emission factors were utilized in the OSDH file. The following sections describe the methods and data applied by ES in updating the existing OSDH inventory.

Annual Questionnaires

The Tulsa City-County Health Department (TCCHD) annually generates NEDS updates for the OSDH master file of point sources within Tulsa County. The update information is supplied by plant representatives on questionnaires developed by OSDH. Coding forms containing the 1977 updates were provided to ES. These were keypunched, converted to EIS/P&R format, and processed through the update program to generate a preliminary 1977 file. ES acquired copies of questionnaire responses for the four major plants outside Tulsa County but within the study area and where appropriate, coded EIS/P&R update transaction and updated the 1976 file. The Agrico Chemical Co. plant was not included in the inventory. It was a relatively new plant, not contained in the 1976 file,

FIGURE III-1

POINT SOURCE METHODOLOGY BASE


1976 OSDH MASTER FILE
1976 NEDS
1976 EIS/P&R
QUESTIONNAIRES
1977 NEDS UPDATES TULSA CO.
1977 EIS/P&R UPDATES OUTSIDE TULSA CO.
INITIAL 1977 EIS/P&R
PLANT VISITS
1977 STORAGE TANK INVENTORY
ADDITIONAL UPDATES FROM FILE REVIEW
FINAL 1977 EIS/P&R

for which sufficient questionnaire information could not be be provided by OSDH. A list of plants whose questionnaire responses were received by ES is shown in Table III-1.

Plant Visits

Because many of the questionnaire responses were incomplete or inconsistent, visits were made to the 14 plants with the most significant VOC or NO_x emission (identified in Table III-1). During the visits, sufficient information was gathered to supplement or verify data provided by the 1977 questionnaire. Based on the information, additional EIS/P&R update transactions were coded. A supplementary questionnaire, covering the oxidant season, was transmitted to the plants with the annual questionnaire by TCCHD. Included on the oxidant season questionnaire were requests for operating and emissions data as well as available information on pollutant component emissions for VOC and NO_x and on projected operation in 1982 and 1987. The aforementioned plant visits were also used to collect additional data or clarify information for the oxidant season questionaires.

Coordinates

ES then conducted a rather detailed review of the initial master file for 1977. A problem with UTM coordinates was first identified. Several were missing but many more had coordinates that did not correspond to the indicated UTM zone. The inconsistency was caused by the zone boundary dividing the City of Tulsa. In fact, at least one plant was located in two UTM zones. ES worked with both TCCHD and OSDH to rectify the inconsistencies to obtain the missing coordinates and then updated the master file. A few mobile asphalt units could not be assigned locations, but their emissions were relatively insignificant. Geomet, Incorporated, the developer of the OCS coordinate system, calculated the OCS coordinates from the UTM data provided by ES. EIS/P&R update transactions for the OCS coordinates were coded and utilized to update the 1977 master file. The UTM zone was changed to 99 as an indicator that location was not given in the UTM system.

Operating Schedules

ES discovered that operating schedule data were missing for many sources. Data on percent operation by season and hours per day, days per week, and weeks per year of operation were required for sources not covered by the temporal factor file. The methodology used to apply the EIS/P&R operating

TABLE III-1

INVENTORY AREA POINT SOURCES SUBMITTING QUESTIONNAIRE RESPONSES

COMPANY	NATURE OF SOURCE	PLANT VISIT
Public Service Co. of Oklahoma (OOLOGAH)	Utility	YES
OKC Refining Okmulgee	Refinery	YES
Public Service Co. of Oklahoma (Tulsa)	Utility	YES
Public Service Co. of Oklahoma (Riverside)	Utility	YES
Armco Steel	Steel Works	NO
Fibercast	Miscellaneous Plastics	NO
McDonnell-Douglas	Aircraft Assembly	NO
Conoco (Cherokee)	Petroleum Pipeline	NO
Explorer Pipeline	Petroleum Pipeline	YES
American Airlines	Aircraft Assembly	NO
Rockwell International (North Mingo)	Aircraft Assembly	NO
Rockwell International (North Memorial)	Aircraft Assembly	NO
Williams Pipeline Co.	Petroleum Pipeline	YES
Texaco, Inc.	Refinery	YES
Gulf	Petroleum Pipeline	NO
Texaco Sales Terminal	Petroleum Loading	YES
Sun Oil Co.	Refinery	YES
Agrico Chemical Co.	Chemical Manufacturing	YES
Martin Marietta Cement Co.	Cement Manufacturing	YES
Texaco Tank Farm	Tank Farm	YES
Sun Terminal	Petroleum Loading	YES
Sun Pipeline	Petroleum Pipeline	YES

schedule data is described in Chapter VII. ES collected the missing information on operating schedule and updated the 1977 file with it.

Refineries

During the detailed review of the emissions for the three refineries in the study area, ES found that outdated emission factors had in some cases been used and also that fugitive emissions were not included for the refining operations in Tulsa County. ES utilized emission factors recommended in Compilation of Air Pollutant Emission Factors (EPA publication AP-42) to estimate emissions for these sources and subsequently update the master file.

Storage Tanks

It was determined during the update process that a great deal of inconsistency existed in the data available for storage tanks. Emission rates, throughputs, and tank capacities often varied from the OSDH 1976 master file to the information contained in the questionnaires or obtained from the plant visits. ES discovered that in many cases, outdated AP-42 Supplement 5 emission factors (revised by Supplement 7) had been used. Different products were identified as being stored in the same tank, and several fixed roof tanks had apparently been converted to a floating-roof type. These inconsistencies necessitated the use of a separate storage tank survey connducted by OSDH representative of calendar year 1977. Sufficient information was in general collected during the survey to enable the calculation of emission factors and emissions. Besides emissions, ES also updated throughputs, tank capacities, and SCCs when necessary. All tanks with emissions of 25 tpy or greater were added to the file. Changes were generated or records added for approximately 200 storage tanks in the study area. Assumptions made during the development of these transactions were:

- o vapor pressures were taken from AP-42 at ambient temperatures unless specified otherwise by the company;
- o if tanks contained more than one product during the year, the most volatile was assumed to be stored during the oxidant season (when storage periods were unspecified);
- o annual meteorological conditions (e.g., wind velocity, diurnal temperature variations, etc.) were taken from 30 year averages at Tulsa International Airport;

- any other data missing from the survey forms or questionnaire responses, such as molecular weight, seal factor, paint factor, density, etc., was taken from AP-42; and
- if no temporal variations were given, it was assumed that 25% of the annual throughput occurred during the oxidant season.

In a few cases that company data were considered insufficient or inaccurate, an estimate was made based on AP-42 and engineering judgement.

ES provided copies of the final 1977 EIS/P&R master file to both TCCHD and OSDH for documentation of the updates mode to the file and for their review. ES reviewed the refinery data point by point with TCCHD. However, no additional comments on the completeness or accuracy of the master file have been received to date.

PROJECTION YEAR INVENTORY DEVELOPMENT

After the base year EIS/P&R master file was completed, the file was duplicated so that it could be updated to generate 1982 and 1987 inventories. The primary source for projection year information was the oxidant season supplements to the annual questionnaires, in conjunction with the plant interview . In general, the following sequence of priorities was used in the generation of the projection factors for existing sources:

- Plant Interviews;
- Plant Questionnaire Responses;
- OBERS projection data; and
- Employment or Population data, depending on the area of interest.

At times, the OBERS data was given priority over the plant questionnaire responses. This was done when it was apparent that very little effort was made in trying to determine future production rates, as when the projection factor 1.0 was used for points throughout the entire plant. However, questionnaire responses were given priority in a majority of cases.

The annual questionnaire supplements requested future projection levels for existing sources and also asked about plans for new plants or expansions in the inventory area. When responses were inadequate, a follow-up call was made to selected plants to verify proposed projections. The data obtained in this manner was given the highest priority.

Data from the individual plants was supplemented with projections obtained from such reference sources as the Tulsa City-County Health Department, the State of Oklahoma, and Radian Co. On a category-by-category basis, ES used each of these sources to cross-check the projections and arrive at the most logical growth factors for input to the ESAQ system.

OBERS Data

The OBERS data used for point sources was the 1972-E set of projections for the three counties in the Tulsa SMSA: Tulsa, Osage, and Creek. As can be seen in Figure I-1, a great deal of the inventory area is covered by these counties. The data in OBERS is listed according to two-digit SIC code. Those used in this study are shown in Table III-2.

Local Population and Employment Data

As a default to all other data sources, county or city population projections were used to project point source emissions. It should be noted that these factors were used only for minor sources. They are listed in Table III-3. For Tulsa County, the default factor was taken from the industry employment category of the Tulsa Metropolitan Area Planning Commission's PLUM output (Projected Land Use Model).

Refinery Emission Projections

Several data sources were contacted in the effort to project refinery emissions for 1982 and 1987. In general, each of the refineries in the Tulsa inventory area (Sun Oil Co., Texaco, Inc., and OKC Refining Co.) indicated that little or no growth was expected through 1987.

Sources at the American Petroleum Institute (API), however, indicated that although no expansion of refining capacity was forecasted for the Tulsa area, nationwide refineries will add an average of 2.4% per year more capacity through 1982. This fact, plus the projections of increased earnings from OBERS (+0.73%/yr) and the State of Oklahoma (+1.1%/yr) indicate that there will be some growth experienced in refining operations in the Tulsa area. This is especially evident in light of the 4.4%/yr increase in gasoline sales projected by OSDH for the 1977 to 1982 period.

TCCHD applied a growth factor which approximates a 1.2% increase per year through 1982 to estimate emissions for the 1979 SIP revision. This would apply to refineries within Tulsa County only (Sun Oil Co. and Texaco,

TABLE III-2

OBERS GROWTH FACTORS USED IN PROJECTION YEAR INVENTORIES

SIC CODE AND DESCRIPTION	1982 GROWTH FACTOR[1]	1987 GROWTH FACTOR[1]
14 - Nonmetallic Mining, except fuels	1.071	1.167
20 - Food and Kindred Products	1.086	1.182
26 - Paper and Allied Products	1.172	1.379
28 - Chemicals and Allied Products	1.095	1.190
33 - Primary Metals Manufacturing	1.128	1.271
34 - Fabricated Metals and Ordinance	1.179	1.389
37 - Transportation Equipment Manufacture	1.117	1.249

[1] Based on 1977.

TABLE III-3

COUNTY POPULATION/EMPLOYMENT PROJECTIONS[1]

COUNTY	CODE	1982	1987
Ottowa	2280	1.029	1.037
Mayes	1900	1.144	1.272
Muskogee (city)	1980	1.056	1.106
Muskogee	2000	1.094	1.196
Okmulgee (city)	2220	1.043	1.091
Rogers County	2620	1.136	1.249
Osage	2260	1.033	1.075
Creek	0760	1.064	1.135
Washington	3140	1.009	1.021
Okmulgee	2240	1.032	1.075
Tulsa[2]	3020	1.137	1.301

[1] Based on 1977.
[2] From PLUM (Industrial Employment).

Inc.). The 1.0%/yr growth factor chosed for the purposes of this study is identical to that projected by the Oklahoma Employment Security Commission, which is based on employment. Therefore, this factor was used in the projections for all three refineries located in the study area.

Before the end of 1979, it is expected that Tulsa County Regulation 15, "Control of Emissions or Organic Materials", will be passed. This regulation mirrors the equivalent State of Oklahoma regulation, although it is more stringent in some areas. TCCHD plans to enforce this regulation, and emission calculations have been made to reflect 1982 compliance by the refinery industry. Accordingly, the projection year inventory has been modified to reflect the control efficiencies for Tulsa County refineries shown in Table III-4. Regulation 15 has been reprinted in Appendix E.

Storage Tank Projections

County Regulation 15 also applies to the storage of gasoline and crude oil. All those tanks within Tulsa County that were not equipped with floating roofs will be required to convert to meet the requirements of the regulation.

TCCHD calculated the total emissions for all tanks within Tulsa County, using a growth factor of 1.0606 from 1977 to 1982. For 1987, a factor of 1.157 was recommended. Although the basis for these factors was Tulsa County population, the resulting 1.2% annual increase corresponds well with refining operations in general. Therefore, these factors were used when direct information from the companies was lacking.

The aforementioned growth factors were used for all storage tanks inventoried. In order to comply with Regulation 15, the control efficiencies found in Table III-5 were added to the gasoline and crude oil tanks with fixed roofs. Therefore, only those plants storing these products under fixed roofs appear in this table.

New floating-roof tanks are being planned for 1979 and 1980 by Gulf and by Texaco, Inc. Calculations show that the emissions for each tank would be as shown in Table III-6. Since each new tank emits less than 25 tons/yr, they are not considered in the projection year inventories.

Power Plant Projections

Data concerning new power plants was obtained from OSDH and from DOE/FERC-0004/1, "Status of Coal Supply Contracts for New Electric Generating

TABLE III-4

1982 AND 1987 REFINERY CONTROLS IN THE TULSA COUNTY

PROCESS	CONTROL
Vacuum Producing Systems	90.5%
Vapor blow-down	98.4%
Water Separators	95.2%
Pumps and Compressors	56.7%
Miscellaneous Fugitive	52.4%

Source: Tulsa City-County Health Department.

TABLE III-5

1982 AND 1987 STORAGE TANK CONTROLS BY PLANT

COMPANY	% CONTROL
Arco	71.4
Bigheart Pipeline	55.7
Kerr-McGee	68.4
Sun Tank Farm	51.6
Sun Pipeline	13.0
Texaco Tank Farm	75.0

Source: Tulsa City-County Health Department.

TABLE III-6

NEW STORAGE TANKS FOR THE INVENTORY AREA

COMPANY	# TANKS	VOC EMISSIONS
Gulf Co.	10	3.9 tons/yr each
Texaco, Inc.	3	Two @ 3.3 tons/yr each One @ 19.4 tons/yr

Source: Questionnaire Responses.

Units", published by the U.S. Department of Energy. The new coal-fired units noted in Table III-7 are being planned for operation before 1982.

Data concerning coal use was given for the year 1981 and 1986. For purposes of our inventory, it was assumed that these years corresponded to 1982 and 1987, respectively. The total amount of coal use projected for these new units are 8.9 million tons for 1982 and 7.9 million tons for 1987.

For existing units, all projections were obtained from interviews with plant officials.

Point Source Emissions Summary

Table III-8 shows base year emissions by county for all plants that are significant emitters of oxides of nitrogen or volatile organic compounds in the Northeast Oklahoma AQCR. Total emissions for all point sources located within each county are summarized in the tables immediately after the individual plants (if any). Similarly, Tables III-9 and III-10 summarize point source emissions data for 1982 and 1987, respectively.

TABLE III-7

NEW COAL-FIRED BOILERS FOR ELECTRIC UTILITIES IN NORTHEAST OKLAHOMA AQCR

UTILITY COMPANY	PLANT	UNIT #	CAPACITY (MW)	DUE ON STREAM
Oklahoma Gas & Electric	Muskogee	4	515	Early 1978
Oklahoma Gas & Electric	Muskogee	5	515	Feb. 1978
Public Service Co. of Oklahoma	Northeastern (Oologah)	3	450	June 1979
Public Service Co. of Oklahoma	Northeastern (Oologah)	4	450	June 1979
Grand River Dam Authority	Steam Plant	1	490	June 1979

TABLE III-8

1977 POINT SOURCE EMISSIONS SUMMARY

IN TONS PER YEAR

	TSP	SO_x	NO_x	HC	CO
CREEK COUNTY					
Kerr-McGee	3	0	186	115	0
* County Total	144	0	191	115	0
MAYES COUNTY					
Grand River Dam	0	0	1,658	170	0
Cherokee Nitrogen	303	0	126	1	7
* County Total	14,291	114	1,881	181	18
MUSKOGEE COUNTY					
Oklahoma Gas & Electric	84	3	2,215	228	2
Brockway Glass Co.	86	84	320	1	6
* County Total	607	87	2,594	245	13
OKMULGEE COUNTY					
OKC Refining Co.	187	2 603	376	3,746	28,487
Midcontinent Pipeline	0	0	0	288	0
* County Total	378	2,603	387	4,621	28,748
OSAGE COUNTY					
Petrolite Div. of Baresco	14	187	148	260	0
* County Total	291	187	148	352	0
ROGERS COUNTY					
Public Serv. Okl. Oologah	74	8	10,364	15	251
Martin Marietta Co.	194	1,392	721	0	2
* County Total	268	1,400	11,085	15	253
TULSA COUNTY					
Sun Oil Refinery	2,081	9,622	9,629	12,382	553
Texaco Refinery	264	4,943	1,467	5,361	63,033
Public Serv. Okl. Tulsa	74	4	2,556	7	125
Armco Steel Corp.	82	0	0	387	2,650
Explorer Pipeline Co.	0	0	0	671	0
Sun Tank Farm	0	0	0	4,017	0
Texaco Tank Farm	0	0	0	4,079	0
Williams Bros. Pipeline	3	8	117	319	14
Cherokee Pipeline	0	0	0	138	0

TABLE III-8 (Continued)

1977 POINT SOURCE EMISSIONS SUMMARY

IN TONS PER YEAR

	TSP	SO_x	NO_x	HC	CO
TULSA COUNTY (Cont)					
Texaco Terminal	0	0	0	332	0
Sun Terminal	0	0	0	640	0
Ford Glass Plant	351	1,606	1,162	3	8
Public Serv. Okl. Jenks	319	160	11,808	34	526
Fibercast Co.	0	0	3	122	0
McDonnell-Douglas	0	0	0	115	0
Kerr-McGee Refining	0	0	0	233	0
* County Total	4,376	17,376	26,880	29,162	66,926
WASHINGTON COUNTY					
National Zinc Co.	1,765	5,785	150	58	0
* County Total	1,960	5,785	150	58	0
OTTOWA COUNTY					
* County Total	18	92	68	2	4
PAWNEE COUNTY					
* County Total	58	0	0	0	0
1977 Grand Total	22,391	27,644	43,384	34,751	95,962

TABLE III-9

1982 POINT SOURCE EMISSIONS SUMMMARY

IN TONS PER YEAR

	TSP	SO_x	NO_x	HC	CO
CREEK COUNTY					
Kerr-McGee	3	0	186	115	0
* County Total	163	0	191	115	0
MAYES COUNTY					
Grand River Dam	514	18,053	19,997	481	952
Cherokee Nitrogen	331	0	138	1	7
* County Total	16,611	18,174	19,242	493	968
MUSKOGEE COUNTY					
Oklahoma Gas & Electric	660	18,813	29,215	682	1,502
Brockway Glass Co.	97	96	363	1	7
* County Total	1,231	18,909	29,642	700	1,,514
OKMULGEE COUNTY					
OKC Refining Co.	196	2,736	395	3937	29,939
Midcontinent Pipeline	0	0	0	306	0
* County Total	409	2,736	407	4,849	30,208
OSAGE COUNTY					
Petrolite Div. of Baresco	14	187	148	260	0
* County Total	311	187	148	358	0
ROGERS COUNTY					
Public Serv. Okl. Oologah	1,012	36,908	46,778	627	2,275
Martin Marietta Co.	220	1,582	821	0	2
* County Total	1,282	38,490	47,599	627	2,277
TULSA COUNTY					
Sun Oil Refinery	2,182	10,113	10,118	2,513	579
Texaco Refinery	277	5,197	1,542	4,112	66,246
Public Serv. Okl. Tulsa	52	3	1,875	6	89
Armco Steel Corp.	87	0	0	410	2,812
Explorer Pipeline Co.	0	0	0	1,125	0
Sun Tank Farm	0	0	0	2,036	0
Texaco Tank Farm	0	0	0	826	0
Williams Bros. Pipeline	3	8	124	336	14
Cherokee Pipeline	0	0	0	146	0

TABLE III-9 (Continued)

1982 POINT SOURCE EMISSIONS SUMMARY

IN TONS PER YEAR

	TSP	SO_x	NO_x	HC	CO
TULSA COUNTY (Cont)					
Texaco Terminal	0	0	0	348	0
Sun Terminal	0	0	0	673	0
Ford Glass Plant	399	1,826	1,321	3	9
Public Serv. Okl. Jenks	319	160	11,808	34	526
Fibercast Co.	0	0	3	139	0
McDonnels-Douglas	0	0	0	128	0
Kerr-McGee Refining	0	0	0	78	0
* County Total	4,620	18,438	26,946	13,089	70,293
WASHINGTON COUNTY					
National Zinc Co.	1,973	6,577	173	58	0
* County Total	2,183	6,577	173	58	0
OTTOWA COUNTY					
* County Total	18	92	68	2	4
PAWNEE COUNTY					
* County Total	62	0	0	0	0
1982 Grand Total	26,841	103,605	124,418	20,291	105,264

TABLE III-10

1987 POINT SOURCE EMISSIONS SUMMMARY
IN TONS PER YEAR

	TSP	SO_x	NO_x	HC	CO
CREEK COUNTY					
Kerr-McGee	3	0	198	123	0
* County Total	186	0	203	123	0
MAYES COUNTY					
Grand River Dam	522	18,054	19,209	503	953
Cherokee Nitrogen	361	0	149	1	9
* County Total	18,863	18,187	19,476	516	973
MUSKOGEE COUNTY					
Oklahoma Gas & Electric	660	18,813	29,215	682	1,502
Brockway Glass Co.	111	109	416	1	8
* County Total	1,292	18,922	29,699	701	1,516
OKMULGEE COUNTY					
OKC Refining Co.	206	2,876	415	4,140	31,477
Midcontinent Pipeline	0	0	0	333	0
* County Total	445	2,876	426	5,104	31,758
OSAGE COUNTY					
Petrolite Div. of Baresco	15	196	156	272	0
* County Total	339	196	156	378	0
ROGERS COUNTY					
Public Serv. Okl. Oologah	770	27,368	37,364	469	1,751
Martin Marietta Co.	244	1,810	938	0	2
* County Total	1,014	29,178	38,302	469	1,753
TULSA COUNTY					
Sun Oil Refinery	2,303	10,629	10,643	2,643	616
Texaco Refinery	288	5,462	1,618	4,324	69,652
Public Serv. Okl. Tulsa	52	3	1,875	6	89
Armco Steel Corp.	95	0	0	447	3,066
Explorer Pipeline Co.	0	0	0	1,197	0
Sun Tank Farm	0	0	0	2,233	0
Texaco Tank Farm	0	0	0	862	0
Williams Bros. Pipeline	3	9	136	367	16
Cherokee Pipeline	0	0	0	159	0

TABLE III-10 (Continued)

1987 POINT SOURCE EMISSIONS SUMMARY IN TONS PER YEAR

	TSP	SO_x	NO_x	HC	CO
TULSA COUNTY (Cont)					
Texaco Terminal	0	0	0	367	0
Sun Terminal	0	0	0	707	0
Ford Glass Plant	457	2,089	1,511	4	10
Public Serv. Okl. Jenks	319	160	11,808	34	526
Fibercast Co.	0	0	3	158	0
McDonnels-Douglas	0	0	0	143	0
Kerr-McGee Refining	0	0	0	82	0
* County Total	4,966	19,582	27,766	13,914	73,996
WASHINGTON COUNTY					
National Zinc Co.	2,203	7,526	196	81	0
* County Total	2,432	7,526	196	81	0
OTTOWA COUNTY					
* County Total	20	96	70	2	4
PAWNEE COUNTY					
* County Total	68	0	0	0	0
1987 Grand Total	29,625	96,563	116,294	21,288	110,000

CHAPTER IV

VOC AND NO_x SPLIT FACTOR FILE GENERATION

In order to provide the pollutant detail required by the Airshed Model, a pollutant split factor table was generated. This table contains individual records showing the typical component makeup of volatile organic compounds and oxides of nitrogen emissions for all appropriate processes. The components tabulated for VOC emissions were:

- paraffins;
- olefins;
- aromatics;
- carbonyls;
- ethylene; and
- non-reactive VOC.

With respect to non-reactive VOC, the Federal Register of July 8, 1978, presents tables which list such compounds of low and negligible reactivity. The named compounds include methane, ethane, acetone, methanol, and acetylene. Unless otherwise noted, these compounds were classified as non-reactive. Benzene; methyl chloride; chloroform; 1,1,1-trichloroethane; ethylene dichloride; and 1,1,2-trichloroethane were also classified as non-reactive, as per the VOC Species Data Manual (EPA-450/3-78-119). Other non-reactive VOC, as specified by EPA's Source-Receptor Analysis Branch (SRAB) include methyl acetate, dimethyl formamide; dichloromethane; carbon tetrabromide; ethyl chloride; 1,1 dichloroethane; perchloroethylene; methylene bromide; and trimethylfluorosilane.

Components tabulated for nitrogen oxides emissions were:

- nitric oxide, NO; and
- nitrogen dioxide, NO_2.

The VOC information in the component file table was used to calculate emissions that fall under two distinct sets of reactivity classifications. One set was used to determine VOC components according to the SAI classification scheme, the other set according the the RAPS classification scheme. The methodologies used for both types of classification appear in Table IV-1. The fractions given by the component factor table in percent by weight and

TABLE IV-1

CLASSIFICATION OF VOLATILE ORGANIC COMPOUND EMISSIONS[a]

SAI NAME	EQUATION
PAR	$= \frac{\text{mass paraffins}^{b}}{14.5} + \frac{\text{mass olefins}^{c}}{14} \times \frac{\text{MW olefin} - 28}{\text{MW olefin}} + \frac{\text{mass aromatics}}{14} \times \frac{\text{MW aromatics} - 78}{\text{MW aromatics}} + \frac{\text{mass carbonyls}}{14} \times \frac{\text{MW carbonyls} - 30}{\text{MW carbonyls}}$
OLE	$= \frac{\text{mass olefins}^{c}}{\text{MW olefins}}$
ARO	$= \frac{\text{mass aromatics}}{\text{MW aromatics}}$
CARB	$= \frac{\text{mass carbonyls}}{\text{MW carbonyls}}$
ETH	$= \frac{\text{mass ethylene}}{28}$

RAPS SCHEME (units are grams)

RAPSPARA = mass paraffins

RAPSOLEF = mass olefins + mass ethylene

RAPSCARB = mass carbonyls

RAPSAROM = mass aromatics

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[a] all percentages by weight
MW = molecular weight

[b] Mass = percent by weight x total VOC emissions

[c] Mass of olefins excluding ethylene

the average molecular weight of each component were used to compute emission rates for a given source.

In cases where a RAPS profile was used (as contained in EPA 600/4-78-028, RAPS Organic Emission Inventory, June 1978), the profile was modified as necessary to include ketones with carbonyls and alkyl acetylenes with unreactives. In addition, average molecular weights are computed for the RAPS profiles using the following equation:

$$\text{avg. MW category}_i = \frac{\text{weight\%}_i}{\text{mole\%}_i}\ (\text{avg. profile MW})$$

In cases where an AP-42 value for aldehyde was used in conjunction with a KVB or RAPS profile, the weight percents of each category were adjusted up or down so that all categories (including unreactives) add to 100 percent.

Acetates and alcohols are two groups of volatile organic compounds which require special treatment when computing the Airshed Model organics classes. This is necessary due to their large presence in the important surface coating source categories. These categories have been included in the "miscellaneous" category in the VOC Species Manual. Actually, acetates contain one carbonyl bond which is properly included in the Airshed Model carbonyl category. The remaining single-bonded carbons were included in the paraffin category. Similarly, each carbon bond in the alcohols was included with paraffins. In addition, diolefins were treated as two separate double bonds. (However, diolefins, unlike alcohols and acetates, represent only a small fraction of VOC emissions). The equations in Table IV-2 may be used for treating these compounds when computing the Airshed Model carbon bond categories.

It should be noted that the equations in Table IV-2 are substantially different from those in Table IV-1. Table IV-2 accounts for alcohols, acetates, and diolefins explicitly while Table IV-1 does not. (Also, olefins are defined in Table IV-2 to include ethylene).

Rather than modifying the computer program to handle these organics classes as inputs, it was possible to modify the paraffin and carbonyl weight percents (and the carbonyl average molecular weight) to account for them. Then, the proper Airshed Model categories were generated using the existing program. The profiles affected are for SCCs 4-02-999-99, 4-02-005-01, 4-02-005-99, 4-02-008-99, 4-02-009-01, and 9-10-051-00. For general solvent evaporation (9-10-051-00) bond weights rather than average

TABLE IV-2

EQUATIONS FOR COMPUTING AIRSHED MODEL ORGANIC CATEGORIES

AIRSHED CATEGORY NAME	EQUATION
PAR	$\frac{\text{mass olefin}}{14} \times \frac{\text{MW olefin} - 28}{\text{MW olefin}} - 2 \times \frac{\text{mass diolefin}}{\text{MW diolefin}}$
	$+ \frac{\text{mass carbonyls}}{14} \times \frac{\text{MW carbonyls} - 30}{\text{MW carbonyls}}$
	$+ \frac{\text{mass aromatics}}{14} \times \frac{\text{MW aromatics} - 78}{\text{MW aromatics}}$
	$+ \frac{\text{mass alcohols}}{14} \times \frac{\text{MW alcohols} - 18}{\text{MW alcohols}}$
	$+ \frac{\text{mass acetates}}{14} \times \frac{\text{MW acetates} - 46}{\text{MW acetates}}$
	$+ \frac{\text{mass paraffins}}{14.5}$
OLE	$\frac{\text{mass olefin}}{\text{MW olefin}} + \frac{\text{mass diolefin}}{\text{MW diolefin}} - \frac{\text{mass ethylene}}{28}$
ARO	$\frac{\text{mass aromatics}}{\text{MW aromatics}}$
CARB	$\frac{\text{mass carbonyls}}{\text{MW carbonyls}} + \frac{\text{mass acetates}}{\text{MW acetates}}$
ETH	$\frac{\text{mass ethylene}}{28}$

category molecular weights were listed. The weight percent for this profile actually represents bond weight percents. This was necessary to account for the large occurrence of several not readily classified compounds which were best treated using a direct bond breakdown.

The final component factor files for volatile organic compounds and nitrogen oxides can be found in Appendix B. The documentation for these component breakdowns appears in the following sections.

POINT SOURCE COMPONENT SPLITS

Volatile Organic Compounds

Each process known to be an emitter of volatile organic compounds (or oxides of nitrogen) was listed according to its NEDS source classification code (SCC). Although several other references addressing VOC components were reviewed, the primary source for the splits was EPA 450/3-78-119, Volatile Organic Compound (VOC) Species Data Manual assembled under contract to EPA by KVB. This reference contains numerous tables which contain VOC breakdowns for a great number of processes emitting volatile organics. Each table is accompanied by a data confidence level (DCL). This figure is an estimate of the accuracy of the data, varying from one for a high degree of confidence to five for "highly judgemental results which could vary from source to source". Table IV-3 identifies those SCCs whose VOC splits were taken directly from the KVB document.

Since the KVB document did not address all the processes found in the point source inventory, alternative data sources or methods were used. Initially, literature sources such as EPA 600/4-78-028, "RAPS Point and Area Source Organic Emission Inventory" were utilized in an attempt to locate a process not included in the KVB publication. Then, if no such process was found, a KVB table dealing with a similar process was used. This procedure was applied to category average molecular weights, as well as the percent by weight data. The goal of this part of the inventorying effort was to find the best information available at the present time.

For several of the SCCs listed in Table IV-3, multiple tables were presented by KVB. The methodology for selecting the proper split involved relating the specific processes as found in the point source master file to the KVB tables. Accordingly, for SCC 30600803, KVB table 3-06-008P, "Petroleum

TABLE IV-3

KVB COMPONENT SPLITS USED IN THE TULSA INVENTORY

PROCESS DESCRIPTION	SCC	DCL*
External Combustion Boilers	10100402	2
	10100501	2
	10100601	2
	10100603	2
	10200401	2
	10200402	2
	10200501	2
	10200601	2
	10200602	2
	10200603	2
	10200701	3
Internal Combustion Engines	20100201	3
	20200102	4
	20200201	3
	20200202	3
Mineral Products Processes	30500201	4
Petroleum Industry Processes	30600201	4
	30600501	3
	30600701	3
	30600801	3
	30600802	3
	30600803	3
	30600804	4
	30600999	4
	30601301	3
Point Source Solvent Evaporation	40100202	2
	40100203	2
	40100205	2
	40200101	3
	40200501	4
	40200599	3
	40200899	4
	40200901	3
Petroleum Products Storage	40300101	3
	40300102	3
	40300103	3
	40300104	3
	40300105	3
	40300201	3
	40300202	3
	40300203	3
	40300204	3
	40300205	3
	40300208	2

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*KVB Data Confidence Level (see following page)

TABLE IV-3 (Continued)

KVB COMPONENT SPLITS USED IN THE TULSA INVENTORY

DCL	DEFINITION
2 - Above Average -	Data reasonably representative of the entire population.
3 - Average -	Reasonable data more or less representative of the population.
4 - Below Average -	Based on little data not sufficient enough to be totally representative of the population.

Industry Refinery Miscellaneous, Pump Seals, Composite" was used. Since unspecified pump seal losses was the only description given in the master file, the composite table was used instead of the other 11 tables, which were specifically oriented to gasoline, gas-oil stock, distillate, naptha, natural gas, or refinery gas emissions. The same criteria were used in generating the splits for pipe/valve flange emissions (SCC 30600801).

For SCC 40200501, KVB table 4-02-005D was chosen. This referred to enamel surface coating in the aircraft industry. For each of the SCCs which began with the digits 304 (industrial process - secondary metals), KVB table 3-03-008B (iron sintering) was used for the VOC split.

SCC code 30600104 refers to a petroleum industry process heater, and the KVB table for natural gas external combustion boiler was used (table 1-01-006).

For the VOC split of SCC code 40299999, Table 4-02-005C was used. This is the composite table for surface coating evaporation for wood furniture. Splits for SCC parrafin code 30600602 (refinery vacuum jets) were found using "Screening Study for Vacuum Distillation Units in Petroleum Refineries" (EPA 450/3-76-090).

Each of the SCC code listings that begins with 403 refers to evaporation from storage tanks. Table IV-4 shows each 403 listing and the corresponding KVB table used for the VOC split. The KVB splits apply to both breathing and working losses. Table 4-03-001B accounts for storage losses for a refinery's fluidized catalytic cracking unit (FCC). The SCC's which apply to gasoline storage (40300101, -103, -201, -202) were split according to special data obtained from E.I. duPont de Nemours & Co., Inc. A gasoline composition in volume percent which was specific to the Tulsa area for the summer of 1977 was converted to weight percent using KVB molecular weights. The resulting split was chosen over KVB's because it contained a more representative aromatic percentage. The KVB data is based on a gasoline composition specific to the California area. This composition is high in aromatics because the crude oil used to refine gasoline in California is higher than the rest of the nation. Although the DuPont data is for the gasoline itself rather than gasoline vapor, it was considered to be the best data available at the present time.

Table 4-03-001E was also used for SCC codes 40600104 and 40600130. Table 4-03-001A was used for SCC 40600126, while 4-03-001B applied to 40600105.

TABLE IV-4

KVB STORAGE TANK EVAPORATION COMPONENT SPLITS

SCC	KVB TABLE	PRODUCT STORED
40300102	4-03-001D	Crude Oil Composite
40300104	4-03-001D	Crude Oil Composite
40300105	4-03-001E	Commercial Jet Fuel
40300106	4-03-001D	Kerosene
40300107	4-03-001D	Distillate Fuel
40300151	4-03-001D	Kerosene
40300152	4-03-001E	Distillate Fuel
40300203	4-03-001E	Crude Oil
40300204	4-03-001E	Crude Oil
40300205	4-03-001E	Jet Fuel
40300207	4-03-001E	Kerosene
40300208	4-03-001F	Benzene
40399999	4-03-001E	Miscellaneous

Some process emissions besides those already mentioned were split according to KVB Table 1-01-006, external combustion boiler for natural gas. These include those sources with SCC codes 30501401 and 39000699. The SCC code which applied to the coal-fired boilers added to the projection year inventory (1-01-002-99) was split according to the fuel combustion classification found in RAPS table A-1, and modified to agree with AP-42 table 1.1-2.

For SCC codes 30600805, 306(0806, and 30600808, table 3-06-008N, fugitive LPG emissions from relief values in refining operations, was used.

Nitrogen Oxides

For point sources, the component splits for nitrogen oxides vary from 98%/2% NO/NO_2 for processes with low excess air (efficient combustion), to 85%/15% for less efficient combustion processes. Examples of the former include SCCs 101)0402, 10200401, and 10200402. These are large external combustion boilers which utilize residual oil. Sources emitting 15% nitrogen dioxide are exemplified by several processes in the refining industry. Their specific codes are: 30600104 (natural gas process heaters); 30600201 and 30600301 (fluidized catalytic cracking and thermal catalytic cracking, respectively), and 30600999 (flares).

Since no information was available on nitrogen oxide components from any of the plants in the inventory area and very little literature dealing directly with the subject was found, the basic source of the data was consultation with experts in this field. Each of the NO/NO_2 splits was made after consultation with individuals from governmental agencies as well as from the private sector. These individuals include: Robert Hall and Dale Denny of the Research and Development Department of the Industrial Engineering Research Lab, Research Triangle Park, North Carolina; James Southerland of the Air Management Technorelogy Branch, Research Triangle Park; and Basil Dimitriades, Environmental Research Lab, also at Research Triangle Park.

Since duct and stack conditions affect NO/NO_2 ratios, ES attempted to collect data representative of actual stack exit conditions.

AREA SOURCE COMPONENT SPLITS

Two data sources were used in the compilation of the VOC and NO_x component factors for area sources. The first was KVB's VOC Species Data Manual, the other was EPA 600/4-78-028, "RAPS Point and Area Source Organic Emission Inventory".

Volatile Organic Compounds

The data reported in the VOC Species Manual (EPA 450/3-78-119) was used to derive the mobile source VOC profiles. Catalyst and noncatalyst exhaust profiles were combined to obtain a single exhaust profile on the basis of 1977 sales of unleaded and leaded gasoline. This in turn was combined with an evaporative emission profile on the basis of the ratio of exhaust to evaporative emission factors. This was done separately for freeway roads, rural roads, and urban roads. Profiles for 1982 and 1987 were derived on the basis of projected use of unleaded fuel and on projected changes in the ratio of exhaust to evaporative emission factors.

Data obtained from a survey of commercial gasoline composition in Tulsa during the summer of 1977 are shown in Table IV-5. This information was supplied by Joseph Faassen of E.I. duPont de Nemours & Company, Inc., Petroleum Chemical Division, Wilmington, Delaware. The average values for unleaded fuel and leaded regular fuel each represent the arithmetic mean of five samples while those for premium leaded represent the arithmetic mean of four samples. The regular and premium leaded fuel compositions were then combined on the basis of gasoline sales. For the third quarter of 1977, Oklahoma gasoline sales were 69.5% leaded regular, 8.1% leaded premium, and 22.4% unleaded (Ethyl Corporation, 1977). Table IV-6 shows the resulting overall leaded gasoline composition.

The aromatic fuel composition in Table IV-6 is nearly identical to that reported for Table 6-06-021D of the VOC Species Data Manual. This table was therefore used without modification to represent exhaust emissions from noncatalyst vehicles running on leaded fuel. Table 6-06-021B was chosen to represent exhaust emissions from catalyst equipped vehicles running on unleaded fuel. The composition of the corresponding test fuel is shown in Table IV-7. The composition of unleaded fuel in Tulsa is somewhat different, so the exhaust profile was adjusted by the ratio of the fuel composition values for Tulsa (Table IV-5) to those of the test fuel (Table IV-7). The aromatics, including unreactive benzene, were adjusted by the ratio 18.8/26.2, the olefins, including ethylene, by 7.4/6.5, and the paraffins by 73.4/67.3. Thus, a linear relationship was assumed to exist between the fuel composition and

TABLE IV-5

SUMMER OF 1977 GASOLINE COMPOSITIONS IN TULSA

(Faassen, 1979)

GRADE	COMPONENT	PERCENT BY VOLUME AVERAGE	LOW	HIGH
Unleaded Regular	Aromatics	18.8	11	22
	Olefins	7.4	5	11
	Saturates	73.4	67	82
Leaded Regular	Aromatics	22.0	18	25
	Olefins	7.0	4	10
	Saturates	71.0	68	74
Leaded Premium	Aromatics	15.2	10	22
	Olefins	7.5	6	10
	Saturates	77.2	71	83

TABLE IV-6

SUMMER OF 1977 LEADED GASOLINE COMPOSITION IN TULSA

COMPONENT	PERCENT BY VOLUME
Aromatics	21.3
Olefins	7.1
Saturates	71.6

TABLE IV-7

UNLEADED TEST GASOLINE COMPOSITION

(Black and High, 1977)

COMPONENT	PERCENT BY VOLUME
Aromatics	26.2
Olefins	6.5
Paraffins	67.3

the exhaust composition, at least over a narrow range. No adjustments were made for aldehydes, ethane, or methane, their presence being assumed independent of gasoline composition. The resulting normalized profile for unleaded fuel is shown in Table IV-8.

The catalyst exhaust profile (Table IV-8) and the noncatalyst exhaust profile (KVB table 6-06-021D) were then combined into a single profile on the basis of unleaded and leaded gasoline sales (i.e., 77.6% leaded, 22.4% unleaded) as shown in Table IV-9. Projections of future use of unleaded gasoline from USEPA Office of Enforcement indicate that an additive six percent per year increase is expected. Since national use of unleaded gas averaged 34 percent in 1978, unleaded gas is expected to constitute 58 percent of the national fuel mix in 1982 and 88 percent in 1987.

For the evaporative portion of the highway mobile source emissions, KVB table 6-0 -021F was used. No adjustment for gasoline composition was possible because the composition of the test fuel was not known. Although the data were presumably obtained using a gasoline high in aromatics typical of California, more recent unpublished findings from USEPA Environmental Science Research Library using improved analytical techniques indicate that aromatics are typically even higher than reported in KVB table 6-06-021F. Therefore, the data used here slightly underestimates the aromatic composition of the evaporative emissions.

Using the 1977 exhaust profile (Table IV-9) and the evaporative profile (KVB table 6-06-021F), joint profiles were obtained. The evaporative emissions versus exhaust emissions were determined on the basis of MOBILE 1 emission factors for various road types. Exhaust/evaporative percentages are summarized in Table IV-10. This table was generated from MOBILE 1 output (Appendix F), which was derived from input data collected for the Tulsa AQCR by the Oklahoma Department of Transportation. The input data were specific for each road type and included percent hot and cold starts, vehicle mix, and average vehicle speed as previously shown in Tables II-7A and II-7B. The resulting VOC profiles (Appendix B) are specific for each of the three roads types. However, for the portion of the study area within TMAPC traffic zones, only total VMT and emissions by grid were available (as shown in Figure VII-3). Therefore, it was necessary to use a single profile in this case. After consulting with TMAPC, the profile for rural roads (SCC 91106200) was chosen.

TABLE IV-8

ADJUSTED EXHAUST COMPOSITION OF VEHICLES EQUIPPED WITH CATALYSTS BURNING UNLEADED FUEL

COMPONENT	MOLECULAR WEIGHT	PERCENT BY WEIGHT	PERCENT BY VOLUME
Paraffins	80.5	38.2	19.9
Olefins	57.0	17.0	12.5
Ethylene	28.0	11.2	16.8
Aromatics	99.2	10.7	4.5
Carbonyls	30.0	4.6	6.5
Unreactives	--	18.2	39.9
		99.9	100.1

TABLE IV-9

COMBINED LEADED AND UNLEADED FUEL EXHAUST COMPOSITION FOR 1977

COMPONENT	MOLECULAR WEIGHT	PERCENT BY WEIGHT	PERCENT BY VOLUME
Paraffins	90.4	30.1	14.8
Olefins	52.8	16.8	14.0
Ethylene	28.0	11.6	18.0
Aromatics	98.6	16.8	7.5
Carbonyls	30.0	4.0	5.8
Unreactives	--	20.7	39.9
		100.0	100.0

TABLE IV-10

RELATIVE PROPORTION OF EXHAUST VERSUS EVAPORATIVE MOBILE SOURCE EMISSIONS

YEAR	ROAD CLASS	PERCENT EVAPORATIVE	PERCENT EXHAUST
1977	Freeway	49	51
	Rural	47	53
	Urban	30	70
1982	Freeway	44	56
	Rural	41	59
	Urban	22	78
1987	Freeway	33	67
	Rural	30	70
	Urban	13	87

This choice was based on the fact that the MOBILE 1 percent hot and cold starts, vehicle mix, and average vehicle speed inputs for rural roads best represented conditions within the TMAPC traffic zones.

For those categories dealing with natural gas combustion, KVB recommended using 100% methane. Since a gas chromatograph analysis of the natural gas used in Tulsa was available, that analysis was instead used to develop. Methane was 96.2% by weight, with the remainder composed of various paraffins. The implicit assumption was that each component of the gas burns with the same efficiency. For emissions from gas wells and natural gas leaks, the same splits were used as those for residential, commercial, and industrial natural gas use.

For the solvent evaporation category (9-10-051-00), it was determined that 23 percent of the emissions were from degreasing (cold cleaning), 20 percent from architectural surface coating, and 57 percent from general domestic solvent use. A joint profile was constructed by weighing individual profiles. For degreasing, a national mix of cold cleaning solvents reported in "Control of Volatile Organic Emissions from Solvent Metal Cleaning" (EPA 450/2-77-022) was used. Each solvent was assigned to one of the organics classes and then a molecular weight for a solvent typical of the class was selected.

The component split for aircraft emissions was a composite developed by averaging two sources: the RAPS document for airport emissions, and Organic Compounds in Turbine Combustion Exhaust, Conkle, et. al. This reference, copyrighted by the Institute of Electrical and Electronics Engineers, presented VOC splits for JP-4 fuel exhaust. Since the large majority of emissions are due to jet aircraft, this source was deemed appropriate for use in the aircraft VOC split. Average molecular weights were taken from the KVB table for off-highway gasoline vehicles. Table IV-11 references the sources for all other area source categories.

Nitrogen Oxides

As was the case for point sources, very little published data was found concerning area source nitrogen oxide splits. In general, a 95%/5% ratio (by weight as NO_2) is considered acceptable for most categories. This ratio split was used for several of the combustion categories. The highest NO/NO_2 ratio (97%/3%) was assigned to the aircraft category, because aircraft engines

TABLE IV-11

AREA SOURCE VOC SPLITS

SCC	DESCRIPTION	SOURCE	TABLE #
90401300	On-site incineration commercial/institutional	RAPS[3]	A-18
90600700	Farm equipment/gasoline	KVB[1] AP-42	6-06-021D 3.2.6-2
90600800	Construction equipment/gasoline	KVB[1] AP-42	6-06-021D 3.2.7-2
90600900	Small gasoline engines	KVB[1] AP-42	6-06-021D 3.2.5-1
90700700	Farm equipment/diesel	KVB[1] AP-42	6-07-021 3.2.6-2
90700800	Construction equipment/diesel	KVB[1] AP-42	6-07-021 2.3.7-1
90702400	Rail locomotive/diesel exhaust	RAPS[1] AP-42	A -22 3.2.2-1
90904430	Vessels/gasoline	KVB	6-06-021D
91000600	Cutback asphalt (refinery valve/distillate)	KVB	3-06-008F
91000800	Drycleaning (48% petroleum/51% perchlorathylene)	KVB	4-01-001B 4-01-001C
91000900	Pesticides (domestic & commercial)	KVB	6-35-705
91005100	Solvent evaporation (23% degreasing/20% arch-surface coat/57% domestic)	KVB VDU[2]	6-35-103 & 702 2-2
91005200	Gasoline marketing (gasolne vapor composite)	KVB	6-06-021C
91308100	Forest fires	KVB	6-13-081
91308200	Slash/agricultural burning (landscape pruning)	KVB	5-01-002
91308400	Structural fires	RAPS[3]	A-18

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[1] Modified to adjust aldehydes to AP-42 wt%.

[2] Degreasing profile based on national averages from EPA 450/2-77-022; wt. percents reported on a bond basis.

[3] Modified to include ketones along with aldehydes in carbonyls.

are larger and burn hotter and more efficiently than other types of engines. Those categories with the lowest ratios (85%/15%) were high-excess air combustion processes, such as forest fires, structural fires, agricultural burning, open burning, and on-site incineration. The data sources for the area source nitrogen oxide splits were the same as for point sources.

CHAPTER V

TEMPORAL FACTOR FILES

INTRODUCTION

Annual emissions were separated into several temporal divisions. First, the year was divided into four quarters with June, July, and August representing the oxidant season. Also, a typical weekday during the oxidant season was expressed as a fraction of the entire season. Finally, hourly factors were computed for the typical oxidant season weekday. The data were recorded in Central Standard Time and expressed in terms of percentages.

The temporal resolution of area source data was accomplished differently for each individual category. The preferred method of estimation was through direct contact with individuals who work in fields related to the specific categories. Lacking this, several literature sources were utilized. These include: EPA 600 4-77-041, RAPS Off-Highway Mobile Source Emission Inventory; EPA 450/4-79-018, Procedures for the Preparation of Emission Inventories for Volatile Organic Compounds ("Procedures") Volume II; and EPA 450/3-75-078, Residential and Commercial Area Source Emission Inventory Methodology for the Regional Air Pollution Study.

For point sources, the questionnaire responses were used as the primary source of temporal data. For many plants, data was acquired through follow up interviews. Storage tank temporal splits were determined by calculating typical weekday oxidant season emissions and relating them to annualized emissions.

The complete temporal data file for area and point sources is shown in Appendix C. Area sources are referred to by their SCC code. For point sources, temporal factors were provided by plant and point identification. The general methodologies and assumptions made in developing the temporal data file are addressed in the following sections.

AREA SOURCES

Natural Gas Use (90100500, 90200500, 90300500)

This category is divided into three subcategories - residential, commercial, and industrial gas use. From EPA-450/3-75-078 the hourly natural gas flows for the LaClede, St. Louis gas system were obtained. The assumption made in that study was that hourly flows were the same for both the residential and the commercial categories. To simulate the oxidant season, the graph for gas flows at a temperature greater than 68°F was used. Industrial gas diurnal variations were adjusted to reflect slightly greater use during the peak business hours (8 AM to 4 PM local time).

No weekday/weekend day variations were accounted for in the residential category. The industrial subcategory was weighted slightly toward weekdays, while commercial emissions were weighted even more in favor of weekdays.

Residential and commercial seasonal data was also taken from the LaClede study. For the industrial subcategory, data from TCCHD indicated that 9.7 percent of industrial gas use takes place in August, and 10.1 percent in September. The seasonal variation figures were therefore calculated to reflect the higher totals in these months.

Incinerators (90401300)

Information regarding the 25 incinerators operating in Tulsa County indicated that the peak hours were from 8 AM to 5 PM local time. Ten percent of the burning occurred on Saturday, the remaining 90% was done during the week. This data was acquired in conjunction with the incinerator survey taken by TCCHD for the year of record 1977.

Residential Open Burning (90501100)

No seasonal variations were assumed. However, emissions were allocated to the daylight hours only.

Agricultural Equipment (90600700, 90700700)

Temporal variations were obtained from the agricultural extension agent for Tulsa County. The greatest seasonal use occurs during the planting season (March, April, and May). Another peak occurs at harvest time, during the autumn months.

As suggested by the Tulsa County Agricultural Extension Office, equipment use was considered to be constant over the daylight hours only.

Construction Equipment (90600800, 90700800)

Only ten percent of construction equipment use was allocated to the winter months (December, January, and February), the remaining use being evenly divided over the rest of the year. It was assumed that no equipment was run during the nighttime hours.

Small Gasoline Engines (90600900)

Since the great majority of household gas engines in Tulsa are of the lawn and garden variety, the temporal data stressed the summer months and weekend days. Forty percent of the emissions were attributed to June, July, and August. The hourly breakdown was made to the daylight hours.

Rail Locomotives (90702400)

An analysis of the freight schedule in the "Official Railway Guide" showed that more shifts in the Tulsa area occur during the day. Also, there is considerably more activity during the weekdays than during the weekend days. These were reflected in the temporal breakdown of emissions. There are no apparent seasonal variations for this category.

Aircraft (90803100, 90803200, 90803300)

For commercial and military flights, there was little variation in temporal resolution of emissions. According to airport managers, the general tendency was to schedule more flights during the hours people would be awake. This tendency is even more pronounced for civil flights. Also, since private planes are flown more on weekend days, the weekday factor for civil flights was much lower than for the other two categories.

There was no seasonal variation evident for any of the categories for the Tulsa area.

Vessels (90904430)

The seasonal variation for this category was biased against the winter months. Hourly variations were heavily biased in favor of the daylight hours, although some nighttime emissions were allocated to account for fishing at odd hours. The typical weekday factor was relatively low, since only recreational vessels are considered in this category.

Soil Farming (91000100)

Since this is an evaporative emission, the summer months were assumed to have the largest emissions, and 35 percent of the total was attributed to June, July, and August. The hourly emissions were slightly scaled in favor of the hours around mid-day. There are no differences between weekdays and weekend days.

Oil Wells and Gas Wells (91000200, 9 000300)

Seasonal splits for oil wells were determined from base year production data obtained from the Oklahoma Corporation Commmission. The data never varied by more than one percent from 25 percent per quarter, which was used for gas well emissions.

Since production for both categories goes on 24 hours per day and seven days week, the hourly splits reflect this. They are slightly biased, however, for the 8 AM to 5 PM production shift.

According to the information received, there was little or no variation between weekday and weekend day production rates for either category.

Cutback Asphalt (91000600)

The temporal data for this category was made from assumptions concerning the five major companies which use cutback asphalt. Seasonal variations favored the spring and summer months at the expense of the winter months, due to the fact that most roads need repairs most urgently after the winter. Business hours (8 AM to 5 PM) were assumed for the hourly breakdown, with a significant decrease between noon and 1 PM. A five-day work week was assumed.

Natural Gas Leaks (91000700)

The activity parameters for natural gas leaks were expressed as a percentage of total gas consumption. A weighted average was found for the temporal data of residential, commercial, and industrial gas use. Since industrial use was over 68 percent of the total, the seasonal variation was determined to be constant. Hourly variations were assumed to be relatively constant throughout the day. Also, there was no distinction made between weekdays and weekend days.

Dry Cleaning (91000800)

From the survey of dry cleaners taken by TCCHD, it was determined that about 63 percent of the cleaning operations were done between 6 AM and noon. ES assumed that the remainder of the cleaning was done between noon and 5 PM.

No seasonal variations were assumed. Also, the large majority of cleaning operations were assumed to take place on weekdays.

Pesticide Use (91000900)

The use of pesticides occurs mainly in the spring and summer, according to the Oklahoma Department of Agriculture. No weekday/weekend day variations can be assumed, while hourly emissions were slanted slightly toward the daylight hours.

Degreasing, Surface Coating, and Miscellaneous Commercial/Consumer Solvent Use (91005100)

Due to the evaporative nature of the emissions associated with this category, there was some slight bias given to spring and summer emissions. This also would account for any outdoor solvent use. The hourly and weekday/weekend day variations reflect the "workday" nature of this category, since most of the emissions are industrial or commercial. These assumptions are in agreement with EPA-450/3-75-078.

Gasoline Marketing (91005200)

EPA-450/3-75-078 also presents detailed information concerning gasoline sales in the St. Louis, Missouri area. The table entitled "Temporal Allocation Factors for the Filling of Automobile Gasoline Tanks" was used to determine diurnal variations; another table entitled "State of Missouri Gasoline Sales" was used for seasonal variations. The data was in accordance with local information acquired from TCCHD, which shows greater gasoline sales in the late summer months.

No weekday/weekend day variations were found in any of the data sources used for this category.

Highway Motor Vehicles Outside of TMAPC Jurisdiction (91106100, 91106200, 91106400)

For this category, detailed temporal data were available from Oklahoma Traffic Characteristics, 1976, obtained from the Oklahoma Department of Transportation. The methodology used to determine temporal splits was that, for each road classification, a typical road in the inventory area was analyzed for which all necessary temporal data were available. For freeways (limited access roads), stations 94 and 26 were chosen. Station 94 is located on I-44 and U.S. 66 at the Arkansas River Bridge in Tulsa. Station 26 is located on I-40 at the Okmulgee-Okfuskee County Line. The temporal data from each of these was averaged because it was necessary to account for both a rural limited access road and also one located in the city. For rural roads (principal arterials), Station 42, located on U.S. 60 near the junction of U.S. 66 and and U.S. 60, was chosen. For urban roads, Station 35, located 3 miles north of the junction at U.S. 62 in the city of Okmulgee, was chosen. Detailed information concerning all temporal breakdowns required in this study was able to be extracted from the data available.

Forest Fires (91308100)

No temporal variations of any nature were assumed for this category.

Slash Burning (9130822)

No seasonal or weekday/weekend day variations were assumed. However, emissions were assigned only to the daylight hours.

Structural Fires (91308400)

As was the case for forest fires, no temporal variations could be assumed.

POINT SOURCES

The seasonal variations for each plant in the annualized inventory were not in general utilized in the temporal factor file. An oxidant season addendum was attached to the annual questionnaires asking for more specific temporal data. This data included hourly variations and weekday/weekend day variations, as well as seasonal splits. Since few questionnaire responses contained the temporal data desired for the modeling, the plants were also asked for this type of information during the plant interviews and telephone conversations.

For the most significant plants, temporal variations were obtained through the plant interviews. For example, detailed temporal data was obtained from each of the power plants. Hourly breakdowns of power generation for each boiler was obtained, and emissions were assumed to be proportional to power output.

For storage tanks, the following sequence of priorities was used to generate the temporal data file. First, direct data from the company was considered, be it data from the plant interviews or from the responses to the questionnaire addenda. Next, the storage tank inventory developed by the State of Oklahoma Health Department was used. The existing point source inventory was then considered; and finally a year-round split (24-hour per day, 365 days per year) was input, lacking all of the other methods. Changes in throughput were considered as well as emission factors. Emissions for a typical weekday during the oxidant season were calculated utilizing seasonal meteorological conditions, and expanded to seasonal emissions. These calculated seasonal emissions were divided by annual emissions to obtain the seasonal temporal split. For this study, the daily emissions were spread uniformly over a 24-hour period, although some data exist that suggest breathing losses for fixed-roof tanks are greater in the morning hours.

In addition to percent operation by season, the updated EIS/P&R master file contained weeks per year, days per week, and hours per day of operation. These data were used to generate the required temporal detail for sources not included in the temporal factor table. The following assumptions were made in using the EIS/P&R operating data:

1. Eight hour days begin at 7 a.m. and end at 3 p.m. local time;[1]
2. Sixteen hour days begin at 7 a.m. and end at 11 p.m. local time;[1]
3. Six days per week operation excludes Sundays; and
4. A missing operating schedule defaulted to eight hours per day, five days per week, and 52 weeks per year.

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[1] A shift in time of one hour was performed to adjust emissions to Central Standard Time.

CHAPTER VI

ALDEHYDE CORRECTION PROCEDURE

The hydrocarbon emission factors for stationary and mobile nonevaporative sources were largely developed using gas chromatography techniques. With a total hydrocarbon analyzer and an FID detector, formaldehyde is virtually not measured at all while the higher molecular weight aldehydes are detected with a carbon equivalency ratio of something less than one (1.0). Similarly, ketones, particularly acetone, and other oxygenated organics are not measured in proportion to their presence. (Most evaporative sources, whose emission factors have generally been developed on the basis of materials balance calculations, are presumed to be unaffected).

In order to compensate for this apparent systematic bias in the emissions data, the total hydrocarbon emissions were adjusted prior to splitting them into organics categories. Using the weight percent of formaldehyde from the VOC Species Manual, the following correction was applied on an SCC-by-SCC basis:

$$\text{Adjusted HC Emissions} = \text{HC Emissions} \times \frac{100}{100 - \text{wt\% formaldehyde}}$$

Several considerations were involved in selecting formaldehyde as the correction factor. Use of the carbonyls category (defined as ketones and aldehydes in the VOC Species Manual) might tend to overcompensate for some nonevaporative source categories with significant emissions of acetone. (Acetates which should also be included with the other carbonyls, are not affected since these compounds are associated with evaporative sources, primarily surface coating, for which materials balance calculations have been used for emission factor development). Therefore, the correction was restricted to aldehydes. Even then, some overcorrection could result if higher molecular weight aldehydes are present to a significant degree. However, KVB reports all aldehydes as formaldehyde (HCHO). Thus, the weight percent of formaldehydes itself underestimates the presence of other aldehydes. Qualitatively at least, the weight percent of aldehydes @ HCHO offers the best choice for removing a systematic underestimation of total hydrocarbon emissions.

Several source categories with aldehyde emissions did not, however, require any correction. These categories report aldehyde emission factors explicitly in AP-42. Such categories include a few stationary sources. bituminous coal combustion, refinery process heaters (gas), and catalytic crackers (fluid). Off highway mobile sources include agricultural equipment (gas and diesel), construction equipment (gas and diesel), small gasoline engines, and diesel locomotives. In cases where a combined emission factor which includes aldehydes is used, no further aldehyde correction was made.

Table VI-1 lists for each SCC in Tulsa, both point and area, the appropriate weight percent aldehyde @ HCHO to be used for the emission adjustment. Only those SCC's for which the aldehyde correction was necessary are listed. This excludes those sources for which the emission factor already included aldehydes, and also those sources with no aldehyde emissions.

TABLE VI-1

TULSA HC EMISSIONS ALDEHYDE ADJUSTMENT

SCC	DESCRIPTION	ALDEHYDE @ HCHO WEIGHT %	KVB TABLE #
POINT			
1-01-004-02	Residual Oil/Electrical Generation	42.0	1-01-004
1-01-005-01	Distillate Oil/Electrical Generation	48.7	1-01-005
1-01-006-01	Natural Gas/Electrical Generation	8.0	1-01-006
1-01-006-03	Natural Gas/Electrical Generation	8.0	1-01-006
1-02-004-01	Residual Oil/Industrial	42.0	1-01-004
1-02-004-02	Residual Oil/Industrial	42.0	1-01-004
1-02-005-01	Distillate Oil/Industrial	48.7	1-01-005
1-02-006-01	Natural Gas/Industrial	8.0	1-01-006
1-02-006-02	Natural Gas/Industrial	8.0	1-01-006
1-02-006-03	Natural Gas/Industrial	8.0	1-01-006
1-02-007-01	Process Gas/Industrial	7.6	1-01-007
2-01-002-01	Natural Gas Turbine	30.0	2-01-002
2-02-002-01	Natural Gas Turbine	30.0	2-01-002
2-02-002-02	Natural Gas Reciprocating	1.0	2-02-002A
3-05-002-01	Asphaltic Concrete/Rotary Dryer/Gas	8.0	3-05-002A
3-05-014-01	Glass Manufacture/Soda-lime Fnc/Gas	8.0	1-01-006
3-06-002-01	Petroleum Industry/Fluid Crackers	51.0	3-06-002
3-06-003-01	Petroleum Industry/Catalytic Crackers	51.0	3-06-002
3-06-009-99	Petroleum Industry/Flares/Not Classified	20.0	3-06-009
3-90-006-05	Inprocess Fuel/Natural Gas	8.0	1-01-006
4-02-008-99	Surface Coating/Coating Oven/Enamel	3.3	4-02-008E
AREA			
9-04-013-00	On-Site Incineration	7.0	*
9-08-031-00	Military Aircraft	6.0	**
9-08-032-00	Civil Aircraft	6.0	**
9-08-033-00	Commercial Aircraft	6.0	**
9-09-044-30	Vessels/Gasoline	3.8	6-06-021D
9-10-051-00	Solvent Evap (Degreasing/Paint/Domestic)	0.3	6-35-103, -702
9-10-061-00	Freeway Roads	2.2	6-06-021A&F
9-10-062-00	Rural Roads	2.5	6-06-021A&F
9-10-064-00	Urban Roads	3.3	6-06-021A&F
9-13-084-00	Structural Fires	7.0	*

* From RAPS EPA 600/4-78-026 RAPS Organic Emission Inventory.

** From RAPS and Organic Compounds in Turbine Combustion Exhaust, Conkle, et. al.; The Institute of Electrical and Electronics Engineers, Inc.

CHAPTER VII

PREPARATION OF EMISSIONS PACKETS FOR THE AIRSHED MODEL

Emissions input for the Airshed Model is composed of four different sets of information called packets. The types of data included in each packet are as follows:

Packet	Data Type
GRID VALUES	Three separate sets of gridded emissions for minor point, area, and line sources for each hour for 24 hours.
EMISSIONS VALUES	Emissions for major (elevated) point sources for each hour for 24 hours.
POINT SOURCES	Stack data for major (elevated) point sources, time invariant.
TIME INTERVAL	Beginning and end date and time for each hour for 24 hours.

The specific data formats for these packets are shown in Tables VII-1 through VII-5. Each EMISSIONS VALUES or GRID VALUES packet must be placed within a TIME INTERVAL packet to associate the emission rate provided with a specific hour of the day (e.g., 12 midnight to 1 a.m.).

The preparation of packet files for the Airshed Model consisted of a stepwise process of obtaining appropriate emissions disaggregation factors, calculating hourly emissions for all emission components, and placing information in the required packet format for use by the Airshed Model. Schematic representations of the data processing system are shown in Figures VII-1 through VII-5. Components of the data processing system used to produce the packets are:

- VOC and NO$_x$ split factor tables;
- Temporal distribution factor tables for seasonal, weekday, and hourly periods;
- EIS/P&R point and area source files and associated data handling routines;
- TMAPC gridded, hourly highway vehicle inventory of particulates, SO$_2$, CO, NO$_x$, and VOC for Tulsa metropolitan area;
- Data preparation program for accessing the factor tables and emissions for the production of hourly values and the reporting of stack data; and

TABLE VII-1

GRID VALUES PACKET FORMAT

CARD NUMBER/ NAME	ITEM/COLUMNS	COMMENTS
1/Packet Header	Header/1-10	GRID VALUES, left adjusted
2+/Grid Emissions	Subregion Name/1-10	TULSA
	Pollutant Name/11-20	See Table VII-3 for names
	Column No./21-30	X-index of grid, counting from bottom (South) column = 1
	Row No./31-40	Y-index of grid, counting from left (West) row = 1
	Emission Value/41-50	Units are gram-moles/hr except grams/hr for AEROSOLS
3/Packet Terminator	Terminator/1-3	END, left adjusted

TABLE VII-2

EMISSIONS VALUES PACKET FORMAT

CARD NUMBER/ NAME	ITEM/COLUMNS	COMMENTS
1/Packet Header	Header/1-10	EMISSIONS VALUES, left adjusted
2+/Point Source Emissions	Point Source ID/1-10	EIS/P&R county, plant, and point ID number
	Pollutant Name/11-20	See Table VII-3 for names
	Emission Value/21-30	Same units as GRID VALUES
3/Packet Terminator	Terminator/1-3	END, left adjusted

TABLE VII-3

FIELDS COMMON TO GRID AND EMISSIONS VALUES PACKETS

CARD NUMBER/ NAME	COLUMN	DESCRIPTION	VALUE
2+/Grid or Point Source Emissions	61	Source Type	Major or Minor Point - P
			Area - A
			Line - L
	62 and 63	Year	Last two digits of year
	64	Projection Type	Base Year - B
			Baseline Projection Year (growth) - G
			Strategy - S
	65	Projection Number	0
	66		Blank
	67	Weekday Code	1
	68 and 69	Hour Number	Midnight to 0100 - 01
			0100 to 0200 - 02
			: :
			2300 to 2400 - 24
	70		Blank
	71 and 72	Pollutant ID	CO - 01
			SO_2 - 02
			AEROSOLS - 03
			NO - 04
			NO_2 - 05
			PAR - 06
			OLE - 07
			CARB - 08
			ARO - 09
			RAPSPARA - 10
			RAPSOLEF - 11
			RAPSALDE - 12
			RAPSAROM - 13
			ETH - 14

TABLE VII-4

POINT SOURCES PACKET FORMAT

CARD NUMBER/ NAME	ITEM/COLUMNS	COMMENTS
1/Packet Header	Header/1-10	POINT SOURCES, left adjusted
2+/Point Source ID and location	Point Source ID/1-10	Same as EMISSIONS VALUES
	Source Type/11-20	PLUMERISE if stack data are complete; STACKHGT if data are missing
	X-location/21-30	X-coordinate with respect to reference origin (meters)
	Y-location/31-40	Y-coordinate with respect to reference origin (meters)
3+/Stack Properties	Stack Height/1-10	Ground to top of stack (meters)
	Stack Exit Diameter/ 11-20	For flow rate calculation (meters)
	Stack Exit Temperature/21-30	For heat flux calculation (°K)
	Stack Exit Velocity/ 31-40	For flow rate calculation (meters/second)
4/Packet Terminator	Terminator/1-3	END, left adjusted

TABLE VII-5

TIME INTERVAL PACKET FORMAT

CARD NUMBER/ NAME	ITEM/COLUMNS	COMMENTS
1/Packet Header	Header/1-10	TIME INTERVAL, left adjusted
2/Time Interval	Beginning Date/1-10	yy001 - yy is last two digits of year
	Beginning Time/11-20	hh00 - hh is begin time for hour - starts at 00 and ends at 23
	End Date/21-30	Same as Beginning Date
	End Time/31-40	hh00 - hh is end time for hour - starts at 01 and ends at 24
3/Packet Terminator	Terminator/1-6	END TIME, left adjusted

FIGURE VII-I

PREPARATION OF GRIDDED AREA SOURCE MASTER FILE

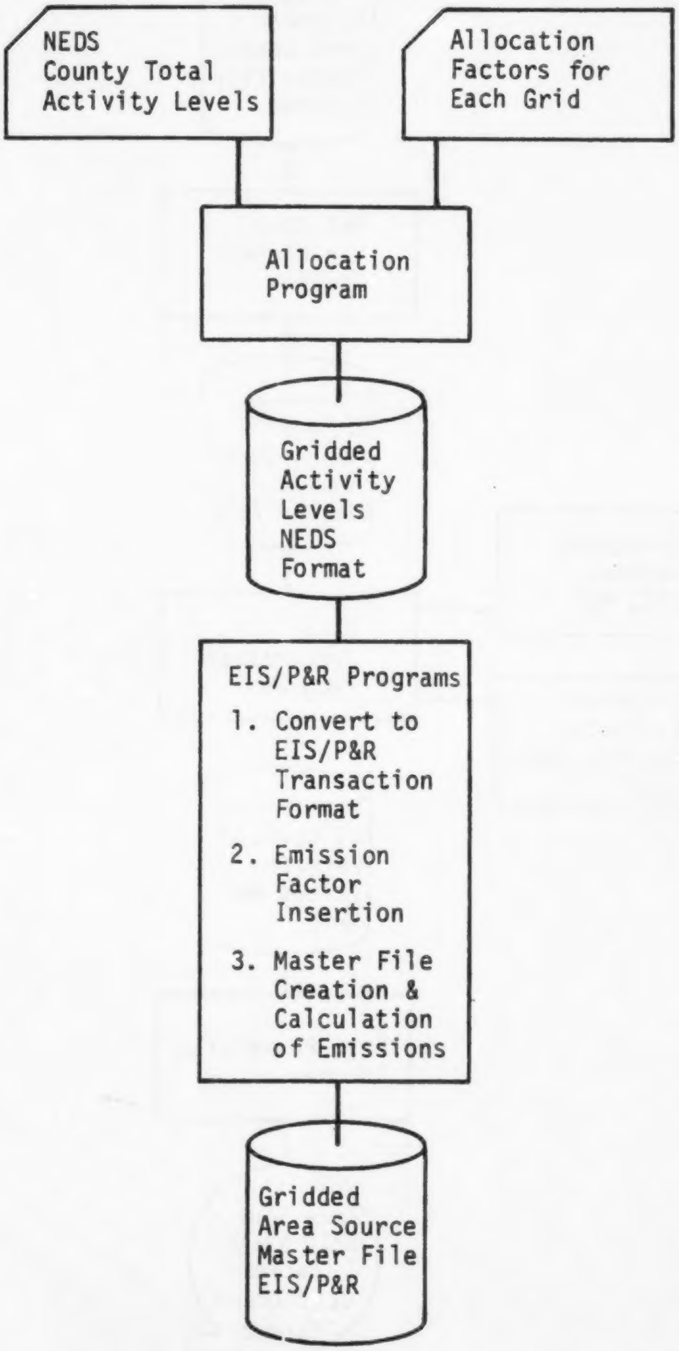

NEDS County Total Activity Levels
Allocation Factors for Each Grid
Allocation Program
Gridded Activity Levels NEDS Format
EIS/P&R Programs
1. Convert to EIS/P&R Transaction Format
2. Emission Factor Insertion
3. Master File Creation & Calculation of Emissions
Gridded Area Source Master File EIS/P&R

FIGURE VII-2

PREPARATION OF AIRSHED MODEL DATA PACKET FOR AREA SOURCES

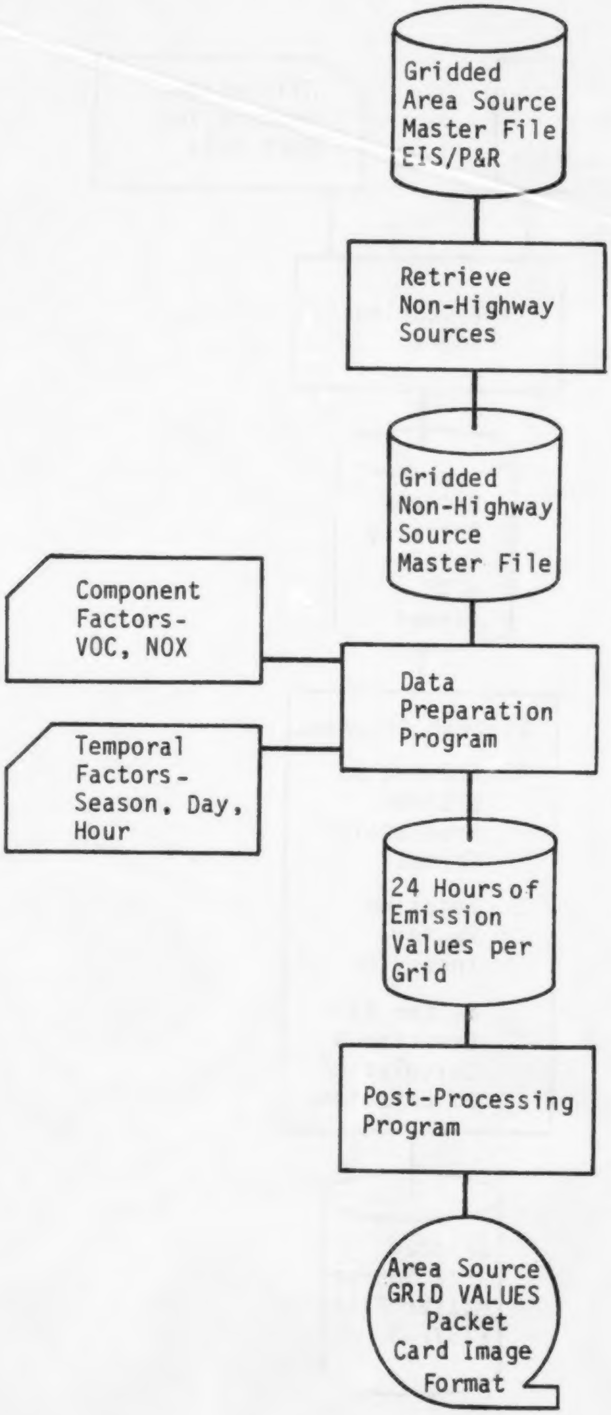
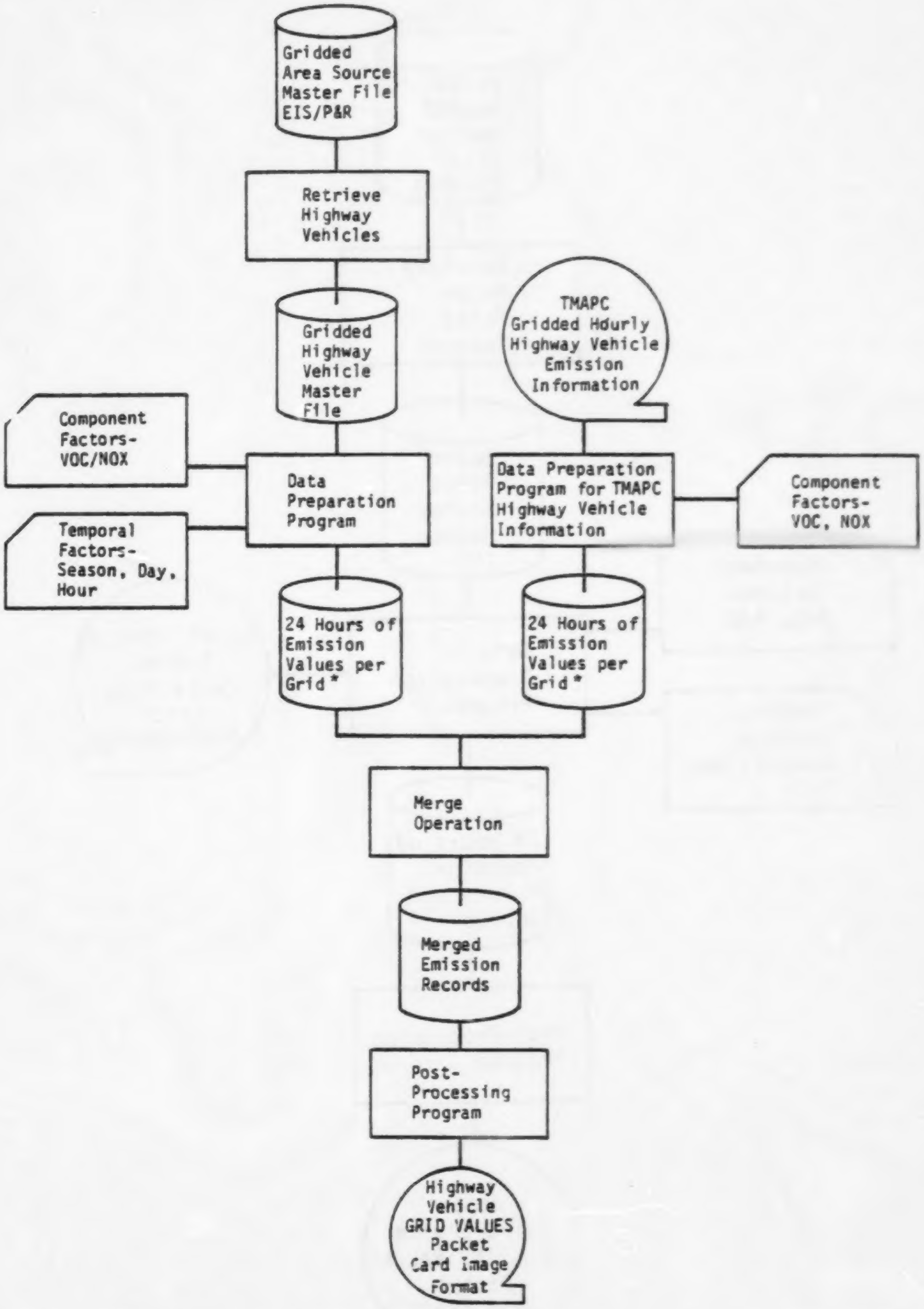

Gridded Area Source Master File EIS/P&R
Retrieve Non-Highway Sources
Gridded Non-Highway Source Master File
Component Factors-VOC, NOX
Data Preparation Program
Temporal Factors-Season, Day, Hour
24 Hours of Emission Values per Grid
Post-Processing Program
Area Source GRID VALUES Packet Card Image Format

FIGURE VII-3

PREPARATION OF AIRSHED MODEL DATA PACKET FOR HIGHWAY VEHICLES


Gridded Area Source Master File EIS/P&R
Retrieve Highway Vehicles
Gridded Highway Vehicle Master File
TMAPC Gridded Hourly Highway Vehicle Emission Information
Component Factors-VOC/NOX
Temporal Factors-Season, Day, Hour
Data Preparation Program
Data Preparation Program for TMAPC Highway Vehicle Information
Component Factors-VOC, NOX
24 Hours of Emission Values per Grid*
24 Hours of Emission Values per Grid*
Merge Operation
Merged Emission Records
Post-Processing Program
Highway Vehicle GRID VALUES Packet Card Image Format

*Data sets are complementary. Emissions contained in one file are not included in the other.

FIGURE VII-4

PREPARATION OF AIRSHED MODEL DATA PACKET FOR MAJOR POINT SOURCES

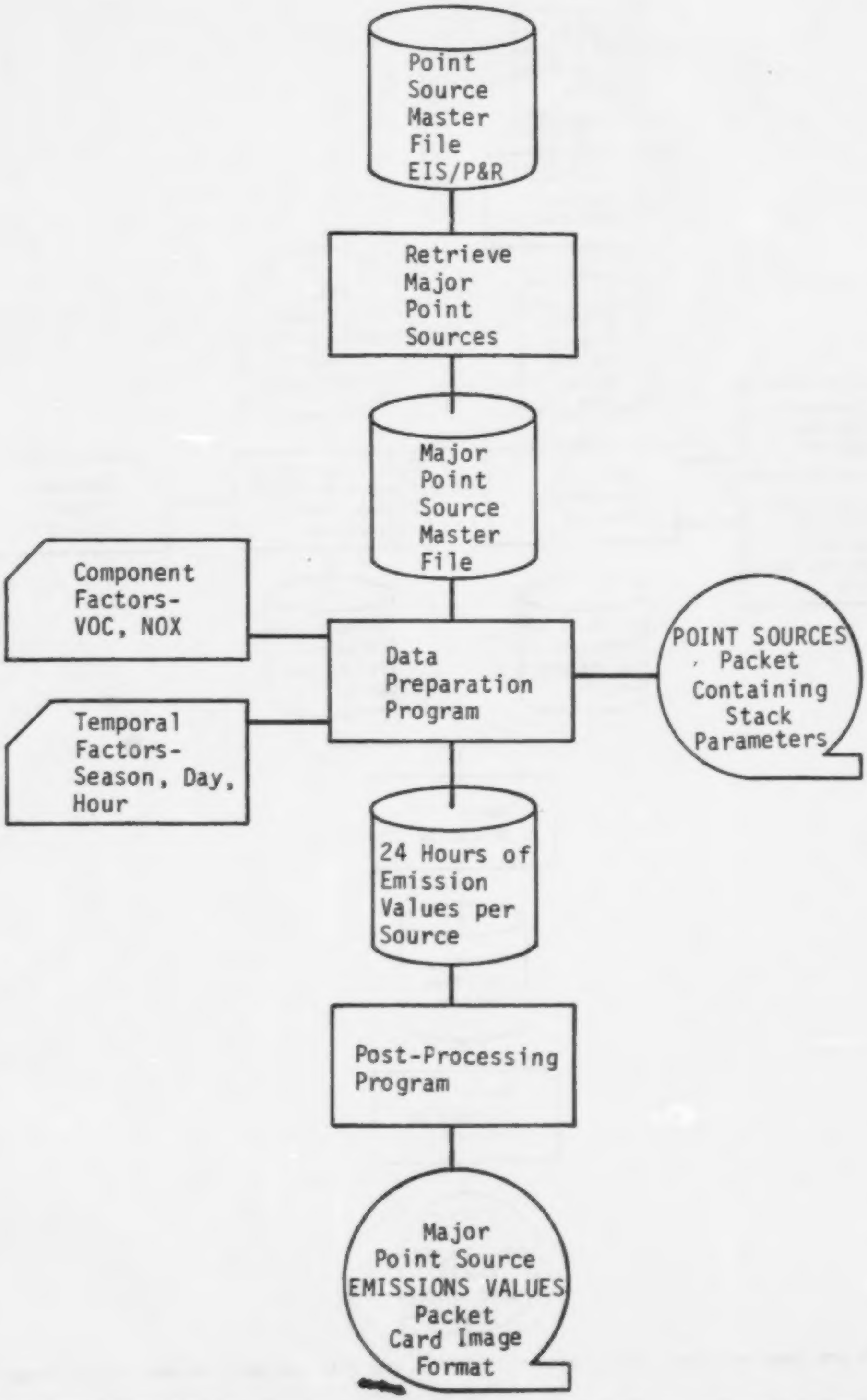
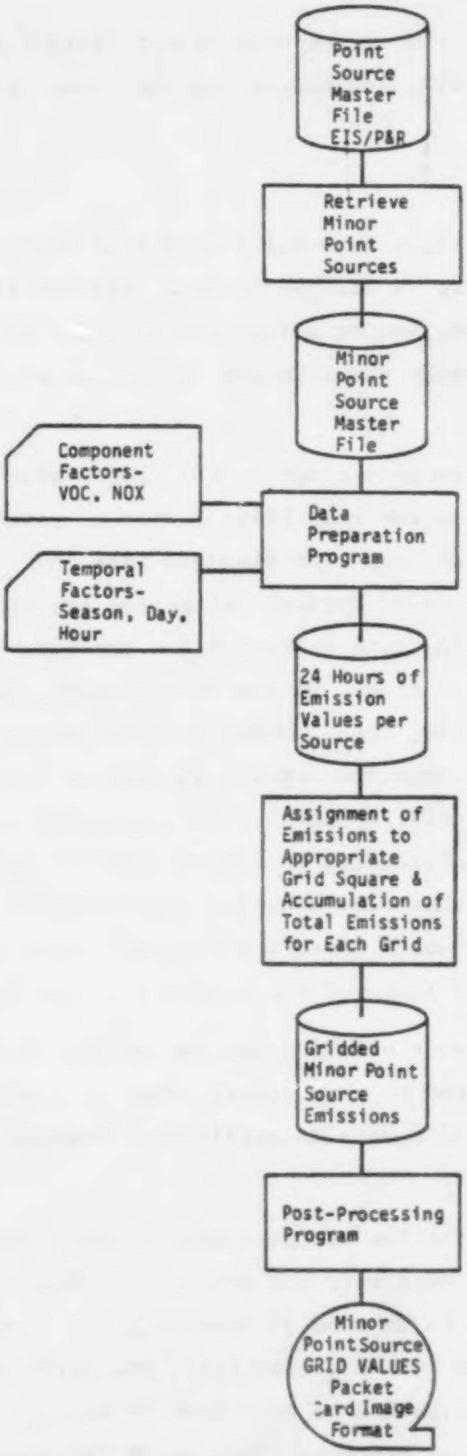

Point Source Master File EIS/P&R
Retrieve Major Point Sources
Major Point Source Master File
Component Factors- VOC, NOX
Temporal Factors- Season, Day, Hour
Data Preparation Program
POINT SOURCES Packet Containing Stack Parameters
24 Hours of Emission Values per Source
Post-Processing Program
Major Point Source EMISSIONS VALUES Packet Card Image Format

FIGURE VII-5

PREPARATION OF AIRSHED MODEL DATA PACKET FOR MINOR POINT SOURCES


Point Source Master File EIS/P&R
Retrieve Minor Point Sources
Minor Point Source Master File
Component Factors- VOC, NOX
Data Preparation Program
Temporal Factors- Season, Day, Hour
24 Hours of Emission Values per Source
Assignment of Emissions to Appropriate Grid Square & Accumulation of Total Emissions for Each Grid
Gridded Minor Point Source Emissions
Post-Processing Program
Minor PointSource GRID VALUES Packet Card Image Format

- o Post-processing programs for separation of major and minor point sources and the creation of packet files in the required format for the Airshed Model.

The first two components of the system were addressed in Chapters IV and V, respectively. The four remaining components and their use are described in the following sections.

Emission Files

Except for highway motor vehicle data which came from TMAPC, the emission files used in this study were in EIS/P&R format. EIS/P&R is a subsystem of the Comprehensive Data Handling System maintained by EPA. It contains the same information as NEDS but is more flexible and capable of storing much more information.

Two basic types of files were maintained by ES: point sources and area sources. The area source file had the same basic format as point sources but a slightly different file organization. The standard file contains area emissions on a category-by-category basis; typical categories are commercial fuel combustion, gasoline fuel marketing, and vehicle-miles travelled (VMT). Each category consists of several activities. In the VMT category, individual activities are: limited access roads, rural roads, suburban roads and urban roads. For this study, the file organization was changed so that emissions were reported on an activity-by-activity level. Each activity was treated as a discrete emission source contributing to the total emissions of a particular grid square. In this way there was a unique SCC identifier associated with each emission contribution, which eased the task of computing emissions and the temporal distribution and improved the accuracy of the final product.

Another change to the area source file organization was that activity levels and emissions were tabulated by grid square after allocation instead of by county (Figure VII-1). Grid square identification numbers appeared in the AQCR and PLANT ID identifiers.

The point source file organization was unchanged because emissions from each process at a multi-process point were not available. Therefore, a single SCC at a multi-process point had to be used as the basis for applying VOC/NO_x splits. For all multi-SCC points in the master file, the first code represented the most significant contribution to emissions or was one of several codes required to describe the same process. The use of the first SCC thus led to selection of the appropriate VOC/NO_x split factor for the emissions. Since temporal splits were grouped by plant and point instead of SCC, they were unaffected.

It was important to review the inventory before processing began to insure that operating schedule data were in order. The operating information was used in computing the temporal distributions if particular factors did not appear in the temporal factor table. A check of sources with VOC or NO_x emissions greater than zero identified specific processes and SCCs which needed component factors.

For this study, geographic locations were based on the Oklahoma Coordinate System (OCS). The OCS coordinates replaced the UTM coordinates in both the area and point source files. In order to identify the use of OCS coordinates, all UTM zone numbers were changed to "99" in the point source file.

Data Preparation Program

The data preparation program accessed the temporal and VOC/NO_x split factor files and set up a temporary table index. Then, on a source-by-source basis, the program performed a table look-up procedure to find specific component and temporal distribution data. First, this was done by point identification sequence number, then, if necessary, by process.

If temporal data were not found, the normal operating schedule contained in the the master file was used as a basis for computing the point source factors. The Airshed Model requires determination of emissions for each of the 24-hourly periods during the day. Hour one corresponds to midnight to one a.m. central standard time, and so on, ending with hour 24, 11 p.m. to midnight central standard time. In order to generate hourly emissions from the EIS/P&R operating data, certain assumptions had to be made. For sources operating during the June, July, and August (oxidant) season, the typical weekday emission was assumed to be

$$\frac{(\text{\% Emissions In Oxidant Season})(\text{Annual Emissions})}{(\text{Days Of Operation Per Week})(\text{13 Weeks In Oxidant Season})}.$$

Emissions were spread uniformly throughout the number of hours operated per day. Any source not operating 24 hours per day was assumed to begin operation on hour eight (7 a.m. to 8 a.m. central standard time) and continue to operate each succeeding hour until the total hours operated per day was reached.

If component data were not found, the reported component emissions were set to zero and an error message was printed. The preliminary review of the emission files insured that component factors were available for all processes with VOC or NO_x emissions greater than zero. All factors used to disaggregate the annual emissions were listed by the program for documentation purposes.

Once all factors were accessed, component emissions were computed on an hourly basis for each of the 24 hours by multiplying the annual emissions by the appropriate factors. The computed hourly emissions were placed in matrix form similar to that required for the EMISSIONS VALUES output packet. A post-processing program selected emissions for the hour of interest and output the packet in its required format. If the input file contained major point source data, a POINT SOURCES packet was prepared using the Airshed Model format and giving identification, location, stack height, diameter, velocity and temperature. If diameter, velocity, and temperature were all non-zero, PLUMERISE was entered as source type in the POINT SOURCES packet (Table VII-4). This indicated to the Airshed Model that a plume rise should be calculated. If any of the three items were zero, STACKHGT was used as source type, which indicated that plume rise should not be calculated and that the effective height of the plume was equivalent to the height of the stack.

Major/Minor Source Division

Major point sources, those that passed certain criteria for significance, were separated from minor sources using the EIS/P&R retrieval program and processed by the data preparation program. Several criteria were used to select the sources to be included in the POINT SOURCES and EMISSIONS VALUES packets (major point sources). No stack with less than 10 tons per year of VOC or NO_x emissions was considered. The total elevated emissions of VOC or NO_x for a given grid cell had to be greater than 1% of the total regional emissions (500 tons per year cutoff for NO_x and 750 for VOC). The third criterion was that the plume height had to be greater than 50 meters under unstable atmospheric conditions and light winds (two meters per second). The result was that ten plants and 82 points were included as major sources. Only seven of the 1,550 total grids in the modeling region were represented by these plants.

A post-processing program then put the required information is EMISSIONS VALUES packet format. Minor point, area, and line sources were also processed by the data preparation program. However, the output was sent to an intermediate program before being put in packet format. The intermediate program was responsible for assigning the hourly component emissions from each minor point source to the grid in which it was located. The post-processing program then took the output and placed it in GRID VALUES packet format.

Post-Processing Program

A post-processing program was responsible for taking the output from the data preparation program, which produced emission values for each of 24 hours, and creating an EMISSIONS VALUES packet for major point sources or a GRID VALUES packet for minor point, area, or line sources, depending on the input file. A TIME INTERVAL packet was also produced which specified the beginning and ending date and time for which the other packets were valid. For this study emissions data for all sources were furnished for each hour of the oxidant season typical weekday; no persistence of emissions from hour to hour was assumed.

At the request of EPA, ES shifted hourly emissions values one hour so that all values represented Central Daylight time instead of Central Standard time. In addition to supplying the Airshed Model emissions input on magnetic tape, ES provided EPA with EIS/P&R master files for point and area sources, temporal factor files, VOC/NO_x split factor files, area source emission and grid allocation files, and county level NEDS activity parameters on magnetic tape.

APPENDIX A

NEDS FORMS/ACTIVITY PARAMETERS

The following pages show all activity parameters generated for the five counties and two cities within the Tulsa area source inventory area. The figures are documented in Chapter II of this report.

AREA SOURCE
Input Form
Date 7-20-79

Name of Person Completing Form G. T. Vinzani

State		County				AQCR		
1	2	3	4	5	6	7	8	9
3	7	3	0	2	0	1	8	6

	EMISSION ESTIMATES (10² tons)					SULFUR CONTENT (%)				ASH CONTENT (%)		RESIDENTIAL FUEL									
Year of Record	Particulate	SO2	NOx	HC	CO	Anth. Coal	Bitum. Coal	Dist. Oil	Resid Oil	Anth. Coal	Bitum. Coal	Anth. 10¹ tons	Bitumin. 10¹ tons	Dist. Oil 10⁴ Gal.	Resid. Oil 10⁴ Gal.	Nat. Gas 10⁷ ft.³	Wood 10² tons	Action		cd
10 11	12 13 14 15 16	17 18 19 20 21	22 23 24 25	26 27 28 29 30	31 32 33 34 35	36 37	38 39	40 41	42 43	44 45 46	47 48 49	50 51 52 53	54 55 56 57 58	59 60 61 62 63	64 65 66 67 68	69 70 71 72 73	74 75 76 77	78	79	80
77																1533		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL								OFF-HGWY GASOLINE			INDUST FUEL	OFF HGWY DIESEL						
Anth. 10¹ tons	Bitumin 10¹ tons	Dist. Oil 10⁴ Gals.	Resid. Oil 10⁴ Gals.	Nat. Gas 10⁷ Ft³	Wood 10² tons	Anth. Coal 10¹ tons	Bitum. Coal 10¹ tons	Farm 10³ gal	Constr. 10³ gal	Sm. Engn. 10³ gal.	Nat. Gas 10⁷ ft³	Farm 10³ gal	Const. 10⁴ gal		Action		cd
10 11 12 13 14	15 16 17 18 19	20 21 22 23 24	25 26 27 28 29	30 31 32 33	34 35	36 37 38 39 40 41	42 43 44 45 46 47	48 49 50 51	52 53 54 55 56	57 58 59 60 61	62 63 64 65 66	67 68 69	70 71 72 73	74 75 76 77	78	79	80
				956				338	1645	1886	2322	336	1645		A	A	2

ON SITE INCINERATION			OPEN BURNING			GASOLINE FUEL			DIESEL FUEL								
Residential 10¹ tons	Industrial 10² tons	Comm. Inst. 10² tons	Residential tons	Industrial 10² tons	Comm'l - Instit'l. 10² tons	Light Vehicle 10³ Gals.	Heavy Vehicle 10³ Gals.	Off Hiway 10³ Gals.	Heavy Vehicle 10³ Gals.	Off Hiway 10⁴ Gals.	Rail Locomotive 10⁴ Gals.	County Population 10³	Density	Action		cd
10 11 12 13 14 15	16 17 18 19 20	21 22 23 24	25 26 27 28 29 30	31 32 33 34 35 36	37 38 39 40 41 42	43 44 45 46 47 48 49	50 51 52 53 54	55 56 57 58 59	60 61 62 63 64	65 66 67	68 69 70 71 72	73 74 75 76	77	78	79	80
		57	13956								170	429		A	A	3

AIRCRAFT			VESSELS				EVAPORATION		MEASURED VEHICLE MILES								
Military LTO CYC 10²	Civil LTO CYC 10¹	Commercial LTO CYC 10¹	Anth. Coal 10¹ tons	Diesel Oil 10⁴ Gals.	Resid. Oil 10⁴ Gals.	Gasoline 10² Gals.	Solvent Purchased tons yr	Gasoline Marketed 10⁴ Gals.	Limited Access Road 10⁴ Miles	Rural Roads 10⁴ Miles	# GAS WELLS	Urban Roads 10⁴ Miles		Action		cd
10 11 12 13	14 15 16 17 18	19 20 21 22 23	24 25 26 27	28 29 30 31	32 33 34 35 36	37 38 39 40	41 42 43 44 45 46	47 48 49 50 51	52 53 54 55 56 57	58 59 60 61 62 63	64 65 66 67 68 69	70 71 72 73 74 75 76	77	78	79	80
38	25469	2849				293	3751	30900			9			A	A	4

CUTBACK ASPHALT 100 lbs	NT GAS LEAKS 100 lbs	DRY CLN SOLVENT 100 lbs	PESTICIDE USE lbs	FOREST FIRES		MISC + SLASH BURNING		OIL SLUDGE bbls.		Structure Fires #/year	# OIL WELLS				Action		cd
				Area - Acres	Quant. ton/acre	Area - Acres	Quant. tons acre										
10 11 12 13 14 15 16	17 18 19 20 21	22 23 24 25 26	27 28 29 30 31	32 33 34 35 36 37 38	39 40 41	42 43 44 45 46 47	48 49 50	51 52 53 54	55 56 57	58 59 60 61	62 63 64 65 66 67	68 69 70	71 72 73 74 75 76 77	78	79	80
12471	4320	11820	55200			900	3	48		2614	1382			A	A	5

COMMENTS	Action		cd
10 11 12 … 77	78	79	80
TULSA COUNTY	A	A	6

EPA DUR 219
3/72

AREA SOURCE
Input Form
Date ____________

Name of Person Completing Form G. T. Vinzani ____________

State 1-2	County 3-6	AQCR 7-9
37	3020	186

Year of Record 10-11	EMISSION ESTIMATES (10² tons) Particulate 12-16	SO₂ 17-21	NOₓ 22-25	HC 26-30	CO 31-35	SULFUR CONTENT (%) Anth. Coal 36-37	Bitum. Coal 38-39	Dist. Oil 40-41	Resid. Oil 42-43	ASH CONTENT (%) Anth. Coal 44-46	Bitum. Coal 47-49	RESIDENTIAL FUEL Anth. 10¹ tons 50-53	Bitumin. 10¹ tons 54-58	Dist. Oil 10⁴ Gal. 59-63	Resid. Oil 10⁴ Gal. 64-68	Nat. Gas 10⁷ ft.³ 69-73	Wood 10² tons 74-77	Action 78	79	cd 80
82																1614		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL Anth. 10¹ tons 10-14	Bitumin. 10¹ tons 15-19	Dist. Oil 10⁴ Gals. 20-24	Resid. Oil 10⁴ Gals. 25-29	Nat. Gas 10⁷ Ft³ 30-33	Wood 10² tons 34-35	Anth. Coal 10¹ tons 36-41	Bitum. Coal 10¹ tons 42-47	OFF-HGWY GASOLINE Farm 10³ gal 48-51	Constr. 10³ gal 52-56	Sm. Engn. 10³ gal. 57-61	INDUST FUEL Nat. Gas 10⁷ ft³ 62-66	OFF HGWY DIESEL Farm 10³ gal 67-69	Const. 10⁴ gal 70-73	74-77	Action 78	79	cd 80
				993				365	2022	1946	2833	363	2022		A	A	2

ON SITE INCINERATION Residential 10¹ tons 10-15	Industrial 10² tons 16-20	Comm. Inst. 10² tons 21-24	OPEN BURNING Residential tons 25-30	Industrial 10² tons 31-36	Comm'l Instit. 10² tons 37-42	GASOLINE FUEL Light Vehicle 10³ Gals. 43-49	Heavy Vehicle 10³ Gals. 50-54	Off Hiway 10³ Gals. 55-59	DIESEL FUEL Heavy Vehicle 10³ Gals. 60-64	Off Hiway 10⁴ Gals. 65-67	Rail Locomotive 10⁴ Gals. 68-72	County Population 10³ 73-76	Dummy Cd # 77	Action 78	79	cd 80
		43	11733								170	445		A	A	3

AIRCRAFT Military LTO CYC 10² 10-13	Civil LTO CYC 10¹ 14-18	Commercial LTO CYC 10¹ 19-23	VESSELS Anth. Coal 10¹ tons 24-27	Diesel Oil 10⁴ Gals. 28-31	Resid. Oil 10⁴ Gals. 32-36	Gasoline 10² Gals. 37-40	EVAPORATION Solvent Purchased tons yr 41-46	Gasoline Marketed 10⁴ Gals. 47-51	MEASURED VEHICLE MILES Limited Access Road 10⁴ Miles 52-57	Rural Roads 10⁴ Miles 58-63	# GAS WELLS 64-69	Urban Roads 10⁴ Miles 70-76	77	Action 78	79	cd 80
38	28831	3339				366	4690	38300			9			A	A	4

CUTBACK ASPHALT 100 lbs 10-16	NT GAS LEAKS 100 lbs 17-21	DRY CLN SOLVENT 100 lbs 22-26	PESTICIDE USE lbs 27-31	FOREST FIRES Area - Acres 32-38	Quant. ton/acre 39-41	MISC + SLASH BURNING Area - Acres 42-47	Quant. tons/acre 48-50	OIL SLUDGE bbls. 51-54	55-57	Structure Fires #/year 58-61	# OIL WELLS 62-67	68-77	Action 78	79	cd 80
6300	3590	12281	67159			900	3	48		2716	1382		A	A	5

COMMENTS 10-77	Action 78	79	cd 80
TULSA COUNTY 1982	A	A	6

EPA DUR 219
3/72

AREA SOURCE
Input Form
Date ______

Name of Person Completing Form G. T. Vinzani

State		County				AQCR		
1	2	3	4	5	6	7	8	9
3	7	3	0	2	0	1	8	6

Year of Record	EMISSION ESTIMATES (10² tons) Particulate	SO₂	NOₓ	HC	CO	SULFUR CONTENT (%) Anth. Coal	Bitum. Coal	Dist. Oil	Resid Oil	ASH CONTENT (%) Anth. Coal	Bitum. Coal	RESIDENTIAL FUEL Anth. 10¹ tons	Bitumin. 10¹ tons	Dist. Oil 10⁴ Gal.	Resid. Oil 10⁴ Gal.	Nat. Gas 10⁷ ft.³	Wood 10² tons	Action		cd
10–11	12–16	17–21	22–25	26–30	31–35	36–37	38–39	40–41	42–43	44–46	47–49	50–53	54–58	59–63	64–68	69–73	74–77	78	79	80
87																1679		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL Anth. 10¹ tons	Bitumin. 10¹ tons	Dist. Oil 10⁴ Gals.	Resid. Oil 10⁴ Gals.	Nat. Gas 10⁷ Ft³	Wood 10² tons	Anth. Coal 10¹ tons	Bitum. Coal 10¹ tons	OFF-HGWY GASOLINE Farm 10³ gal	Constr. 10³ gal	Sm. Engn. 10³ gal.	INDUST FUEL Nat. Gas 10⁷ ft³	OFF HGWY DIESEL Farm 10³ gal	Const. 10⁴ gal		Action		cd
10–14	15–19	20–24	25–29	30–33	34–35	36–41	42–47	48–51	52–56	57–61	62–66	67–69	70–73	74–77	78	79	80
				1382				354	2407	2039	3358	352	2407		A	A	2

ON SITE INCINERATION Residential 10¹ tons	Industrial 10² tons	Comm. Inst. 10² tons	OPEN BURNING Residential tons	Industrial 10² tons	Comm'l-Instit. 10² tons	GASOLINE FUEL Light Vehicle 10³ Gals.	Heavy Vehicle 10³ Gals.	Off Hiway 10³ Gals.	DIESEL FUEL Heavy Vehicle 10³ Gals.	Off Hiway 10⁴ Gals.	Rail Locomotive 10⁴ Gals.	County Population 10³	Density Cat	Action		cd
10–15	16–20	21–24	25–30	31–36	37–42	43–49	50–54	55–59	60–64	65–67	68–72	73–76	77	78	79	80
		34	9156								170	463		A	A	3

AIRCRAFT Military LTO CYC 10²	Civil LTO CYC 10¹	Commercial LTO CYC 10¹	VESSELS Anth. Coal 10¹ tons	Diesel Oil 10⁴ Gals.	Resid. Oil 10⁴ Gals.	Gasoline 10² Gals.	EVAPORATION Solvent Purchased tons yr	Gasoline Marketed 10⁴ Gals.	MEASURED VEHICLE MILES Limited Access Road 10⁴ Miles	Rural Roads 10⁴ Miles	# GAS WELLS	Urban Roads 10⁴ Miles	Action		cd
10–13	14–18	19–23	24–27	28–31	32–36	37–40	41–46	47–51	52–57	58–63	64–69	70–77	78	79	80
38	3910	3675				440	5364	47500			9		A	A	4

CUTBACK ASPHALT 100 lbs	NT GAS LEAKS 100 lbs	DRY CLN SOLVENT 100 lbs	PESTICIDE USE lbs	FOREST FIRES Area - Acres	Quant. ton/acre	MISC + SLASH BURNING Area - Acres	Quant. tons acre	OIL SLUDGE bbls.		Structure Fires #/year	# OIL WELLS			Action		cd
10–16	17–21	22–26	27–31	32–38	39–41	42–47	48–50	51–54	55–57	58–61	62–67	68–70	71–77	78	79	80
420	2335	12777	81709			900	3	48		2826	1451			A	A	5

COMMENTS	Action		cd
10–77	78	79	80
TULSA COUNTY 1987	A	A	6

EPA DUR. 219
3/72

AREA SOURCE
Input Form
Date ____________

Name of Person Completing Form G. T. Vinzani

State	County	AQCR
1 2	3 4 5 6	7 8 9
3 7	2 2 4 0	1 8 6

						SULFUR CONTENT (%)				ASH CONTENT (%)		RESIDENTIAL FUEL								
Year of Record	EMISSION ESTIMATES (10^2 tons) Particulate	SO$_2$	NO$_x$	HC	CO	Anth. Coal	Bitum. Coal	Dist. Oil	Resid Oil	Anth. Coal	Bitum. Coal	Anth. 10^1 tons	Bitumin. 10^1 tons	Dist. Oil 10^4 Gal.	Resid. Oil 10^4 Gal.	Nat. Gas 10^7 ft.^{3}	Wood 10^2 tons	Action 78	79	cd 80
10 11	12 13 14 15 16	17 18 19 20 21	22 23 24 25	26 27 28 29 30	31 32 33 34 35	36 37	38 39	40 41	42 43	44 45 46	47 48 49	50 51 52 53	54 55 56 57 58	59 60 61 62 63	64 65 66 67 68	69 70 71 72 73	74 75 76 77			
7 7																1 4 5		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL								OFF-HGWY GASOLINE			INDUST FUEL	OFF HGWY DIESEL					
Anth. 10^1 tons	Bitumin. 10^1 tons	Dist. Oil 10^4 Gals.	Resid. Oil 10^4 Gals.	Nat. Gas 10^7 Ft^3	Wood 10^2 tons	Anth. Coal 10^1 tons	Bitum. Coal 10^1 tons	Farm 10^3 gal	Constr. 10^3 gal	Sm. Engn. 10^3 gal.	Nat. Gas 10^7 ft^3	Farm 10^3 gal	Const. 10^4 gal		Action 78	79	cd 80
10 11 12 13 14	15 16 17 18 19	20 21 22 23 24	25 26 27 28 29	30 31 32 33	34 35	36 37 38 39 40 41	42 43 44 45 46 47	48 49 50 51	52 53 54 55 56	57 58 59 60 61	62 63 64 65 66	67 68 69	70 71 72 73	74 75 76 77			
				8 9				2 1 2	4 8	1 1 8	1 4 0	2 1 3	4 8		A	A	2

ON SITE INCINERATION			OPEN BURNING			GASOLINE FUEL			DIESEL FUEL							
Residential 10^1 tons	Industrial 10^2 tons	Comm. Inst. 10^2 tons	Residential tons	Industrial 10^2 tons	Comm'l - Instill. 10^2 tons	Light Vehicle 10^3 Gals.	Heavy Vehicle 10^3 Gals.	Off Hiway 10^3 Gals.	Heavy Vehicle 10^3 Gals.	Off Hiway 10^4 Gals.	Rail Locomotive 10^4 Gals.	County Population 10^3	Density Code	Action 78	79	cd 80
10 11 12 13 14 15	16 17 18 19 20	21 22 23 24	25 26 27 28 29 30	31 32 33 34 35 36	37 38 39 40 41 42	43 44 45 46 47 48 49	50 51 52 53 54	55 56 57 58 59	60 61 62 63 64	65 66 67	68 69 70 71 72	73 74 75 76	77			
			1 0 5 5 0								2 5	2 7		A	A	3

AIRCRAFT			VESSELS				EVAPORATION		MEASURED VEHICLE MILES						
Military LTO CYC 10^2	Civil LTO CYC 10^1	Commercial LTO CYC 10^1	Anth. Coal 10^1 tons	Diesel Oil 10^4 Gals.	Resid. Oil 10^4 Gals.	Gasoline 10^2 Gals.	Solvent Purchased tons yr	Gasoline Marketed 10^4 Gals.	Limited Access Road 10^4 Miles	Rural Roads 10^4 Miles	# GAS WELLS	Urban Roads 10^4 Miles		Action 78	79	cd 80
10 11 12 13	14 15 16 17 18	19 20 21 22 23	24 25 26 27	28 29 30 31	32 33 34 35 36	37 38 39 40	41 42 43 44 45 46	47 48 49 50 51	52 53 54 55 56 57	58 59 60 61 62 63	64 65 66 67 68 69	70 71 72 73 74 75 76	77			
	2 9 5 7						2 3 5	1 4 0	5 8 8 6	4 9 7 5	1 8 7	1 0 7 3		A	A	4

				FOREST FIRES		MISC + SLASH BURNING										
CUTBACK ASPHALT 100 lbs	NT GAS LEAKS 100 lbs	DRY CLN SOLVENT 100 lbs	PESTICIDE USE lbs	Area - Acres	Quant. ton/acre	Area - Acres	Quant. tons acre	OIL SLUDGE bbls.		Structure Fires #/year	# OIL WELLS			Action 78	79	cd 80
10 11 12 13 14 15 16	17 18 19 20 21	22 23 24 25 26	27 28 29 30 31	32 33 34 35 36 37 38	39 40 41	42 43 44 45 46 47	48 49 50	51 52 53 54	55 56 57	58 59 60 61	62 63 64 65 66 67	68 69 70	71 72 73 74 75 76 77			
4 0 4	2 7 1	4 6 6	3 3 5 0 0			4 0 0	3			1 0 8	1 0 9 2			A	A	5

COMMENTS	Action 78	79	cd 80
10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77			
O K M U L G E E C O U N T Y 1 9 7 7	A	A	6

EPA DUR 219
3/72

AREA SOURCE
Input Form
Date ____________

Name of Person Completing Form G. T. Vinzani

State	County	AQCR
1 2	3 4 5 6	7 8 9
3 7	2 2 4 0	1 8 6

Year of Record	EMISSION ESTIMATES (10^2 tons) Particulate	SO$_2$	NO$_x$	HC	CO	SULFUR CONTENT (%) Anth. Coal	Bitum. Coal	Dist. Oil	Resid Oil	ASH CONTENT (%) Anth. Coal	Bitum. Coal	RESIDENTIAL FUEL Anth. 10^1 tons	Bitumin. 10^1 tons	Dist. Oil 10^4 Gal.	Resid. Oil 10^4 Gal.	Nat. Gas 10^7 ft^3	Wood 10^2 tons	Action		cd
10 11	12 13 14 15 16	17 18 19 20 21	22 23 24 25	26 27 28 29 30	31 32 33 34 35	36 37	38 39	40 41	42 43	44 45 46	47 48 49	50 51 52 53	54 55 56 57 58	59 60 61 62 63	64 65 66 67 68	69 70 71 72 73	74 75 76 77	78	79	80
82																150		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL Anth. 10^1 tons	Bitumin. 10^1 tons	Dist. Oil 10^4 Gals.	Resid. Oil 10^4 Gals.	Nat. Gas 10^7 Ft^3	Wood 10^2 tons	Anth. Coal 10^1 tons	Bitum. Coal 10^1 tons	OFF-HGWY GASOLINE Farm 10^3 gal	Constr. 10^3 gal	Sm. Engn. 10^3 gal.	INDUST FUEL Nat. Gas 10^7 ft^3	OFF HGWY DIESEL Farm 10^3 gal	Constr. 10^4 gal		Action		cd
10 11 12 13 14	15 16 17 18 19	20 21 22 23 24	25 26 27 28 29	30 31 32 33	34 35	36 37 38 39 40 41	42 43 44 45 46 47	48 49 50 51	52 53 54 55 56	57 58 59 60 61	62 63 64 65 66	67 68 69	70 71 72 73	74 75 76 77	78	79	80
				92				208	59	122	171	209	59		A	A	2

ON SITE INCINERATION Residential 10^1 tons	Industrial 10^2 tons	Comm. Inst. 10^2 tons	OPEN BURNING Residential tons	Industrial 10^2 tons	Comm'l-Instit. 10^2 tons	GASOLINE FUEL Light Vehicle 10^3 Gals.	Heavy Vehicle 10^3 Gals.	Off Hiway 10^3 Gals.	DIESEL FUEL Heavy Vehicle 10^3 Gals.	Off Hiway 10^4 Gals.	Rail Locomotive 10^4 Gals.	County Population 10^3	Density Code #	Action		cd
10 11 12 13 14 15	16 17 18 19 20	21 22 23 24	25 26 27 28 29 30	31 32 33 34 35 36	37 38 39 40 41 42	43 44 45 46 47 48 49	50 51 52 53 54	55 56 57 58 59	60 61 62 63 64	65 66 67	68 69 70 71 72	73 74 75 76	77	78	79	80
			10909								25	26		A	A	3

AIRCRAFT Military LTO CYC 10^2	Civil LTO CYC 10^1	Commercial LTO CYC 10^1	VESSELS Anth. Coal 10^1 tons	Diesel Oil 10^4 Gals.	Resid. Oil 10^4 Gals.	Gasoline 10^2 Gals.	EVAPORATION Solvent Purchased tons yr	Gasoline Marketed 10^4 Gals.	MEASURED VEHICLE MILES Limited Access Road 10^4 Miles	Rural Roads 10^4 Miles	# GAS WELLS	Urban Roads 10^4 Miles		Action		cd
10 11 12 13	14 15 16 17 18	19 20 21 22 23	24 25 26 27	28 29 30 31	32 33 34 35 36	37 38 39 40	41 42 43 44 45 46	47 48 49 50 51	52 53 54 55 56 57	58 59 60 61 62 63	64 65 66 67 68 69	70 71 72 73 74 75 76	77	78	79	80
	3347						294	180	6651	5622	187	1212		A	A	4

CUTBACK ASPHALT 100 lbs	NT GAS LEAKS 100 lbs	DRY CLN SOLVENT 100 lbs	PESTICIDE USE lbs	FOREST FIRES Area - Acres	Quant. ton/acre	MISC + SLASH BURNING Area - Acres	Quant. tons acre	OIL SLUDGE bbls.		Structure Fires #/year	# OIL WELLS			Action		cd
10 11 12 13 14 15 16	17 18 19 20 21	22 23 24 25 26	27 28 29 30 31	32 33 34 35 36 37 38	39 40 41	42 43 44 45 46 47	48 49 50	51 52 53 54	55 56 57	58 59 60 61	62 63 64 65 66 67	68 69 70	71 72 73 74 75 76 77	78	79	80
457	224	482	40758			400	3			116	1092			A	A	5

COMMENTS	Action		cd
10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77	78	79	80
OKMULGEE COUNTY 1982	A	A	6

EPA DUR 219
3/72

AREA SOURCE
Input Form
Date ________

Name of Person Completing Form G. T. Vinzani

State	County	AQCR
37	2240	186

Year of Record	EMISSION ESTIMATES (10² tons) Particulate	SO₂	NOₓ	HC	CO	SULFUR CONTENT (%) Anth. Coal	Bitum. Coal	Dist. Oil	Resid. Oil	ASH CONTENT (%) Anth. Coal	Bitum. Coal	RESIDENTIAL FUEL Anth. 10¹ tons	Bitumin. 10¹ tons	Dist. Oil 10⁴ Gal.	Resid. Oil 10⁴ Gal.	Nat. Gas 10⁷ ft.³	Wood 10² tons	Action		cd
87																157		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL Anth. 10¹ tons	Bitumin. 10¹ tons	Dist. Oil 10⁴ Gals.	Resid. Oil 10⁴ Gals.	Nat. Gas 10⁷ Ft³	Wood 10² tons	Anth. Coal 10¹ tons	Bitum. Coal 10¹ tons	OFF-HGWY GASOLINE Farm 10³ gal	Constr. 10³ gal	Sm. Engn. 10³ gal.	INDUST FUEL Nat. Gas 10⁷ ft³	OFF HGWY DIESEL Farm 10³ gal	Const. 10⁴ gal		Action		cd
				129				200	70	127	202	201	70		A	A	2

ON SITE INCINERATION Residential 10¹ tons	Industrial 10² tons	Comm. Inst. 10² tons	OPEN BURNING Residential tons	Industrial 10² tons	Comm'l - Instit. 10² tons	GASOLINE FUEL Light Vehicle 10³ Gals.	Heavy Vehicle 10³ Gals.	Off Hiway 10³ Gals.	DIESEL FUEL Heavy Vehicle 10³ Gals.	Off Hiway 10⁴ Gals.	Rail Locomotive 10⁴ Gals.	County Population 10³	Density Code	Action		cd
			11394								25	29		A	A	3

AIRCRAFT Military LTO CYC 10²	Civil LTO CYC 10¹	Commercial LTO CYC 10¹	VESSELS Anth. Coal 10¹ tons	Diesel Oil 10⁴ Gals.	Resid. Oil 10⁴ Gals.	Gasoline 10² Gals.	EVAPORATION Solvent Purchased tons yr	Gasoline Marketed 10⁴ Gals.	MEASURED VEHICLE MILES Limited Access Road 10⁴ Miles	Rural Roads 10⁴ Miles	# GAS WELLS	Urban Roads 10⁴ Miles		Action		cd
	3933						336	220	7534	6368	196	1373		A	A	4

CUTBACK ASPHALT 100 lbs	NT GAS LEAKS 100 lbs	DRY CLN SOLVENT 100 lbs	PESTICIDE USE lbs	FOREST FIRES Area - Acres	Quant. ton/acre	MISC + SLASH BURNING Area - Acres	Quant. tons/acre	OIL SLUDGE bbls.		Structure Fires #/year	# OIL WELLS		Action		cd
517	147	503	49589			400	3			126	1147		A	A	5

COMMENTS	Action		cd
OKMULGEE COUNTY 1987	A	A	6

EPA DUR. 219
3/72

AREA SOURCE
Input Form
Date ____________

Name of Person Completing Form G. T. Vinzani

State 1-2	County 3-6	AQCR 7-9
37	0760	186

Year of Record 10-11	EMISSION ESTIMATES (10^2 tons) Particulate 12-16	SO_2 17-21	NO_x 22-25	HC 26-30	CO 31-35	SULFUR CONTENT (%) Anth. Coal 36-37	Bitum. Coal 38-39	Dist. Oil 40-41	Resid. Oil 42-43	ASH CONTENT (%) Anth. Coal 44-46	Bitum. Coal 47-49	RESIDENTIAL FUEL Anth. 10^1 tons 50-53	Bitumin. 10^1 tons 54-58	Dist. Oil 10^4 Gal. 59-63	Resid. Oil 10^4 Gal. 64-68	Nat. Gas 10^7 ft^3 69-73	Wood 10^2 tons 74-77	Action 78	79	cd 80
77																193		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL Anth. 10^1 tons 10-14	Bitumin. 10^1 tons 15-19	Dist. Oil 10^4 Gals. 20-24	Resid. Oil 10^4 Gals. 25-29	Nat. Gas 10^7 Ft^3 30-33	Wood 10^2tons 34-35	Anth. Coal 10^1 tons 36-41	Bitum. Coal 10^1 tons 42-47	OFF-HGWY GASOLINE Farm 10^3 gal 48-51	Constr. 10^3 gal 52-56	Sm. Engn. 10^3 gal. 57-61	INDUST FUEL Nat. Gas 10^7 ft^3 62-66	OFF HGWY DIESEL Farm 10^3 gal 67-69	Const. 10^4 gal 70-73	74-77	Action 78	79	cd 80
				119				1:15	21	94		109	21		A	A	2

ON SITE INCINERATION Residential 10^1 tons 10-15	Industrial 10^2 tons 16-20	Comm. Inst. 10^2 tons 21-24	OPEN BURNING Residential tons 25-30	Industrial 10^2 tons 31-36	Comm'l-Instit. 10^2 tons 37-42	GASOLINE FUEL Light Vehicle 10^3 Gals. 43-49	Heavy Vehicle 10^3 Gals. 50-54	Off Hiway 10^3 Gals. 55-59	DIESEL FUEL Heavy Vehicle 10^3 Gals. 60-64	Off Hiway 10^4 Gals. 65-67	Rail Locomotive 10^4 Gals. 68-72	County Population 10^3 73-76	77	Action 78	79	cd 80
			9900								25	21		A	A	3

AIRCRAFT Military LTO CYC 10^2 10-13	Civil LTO CYC 10^1 14-18	Commercial LTO CYC 10^1 19-23	VESSELS Anth. Coal 10^1 tons 24-27	Diesel Oil 10^4 Gals. 28-31	Resid. Oil 10^4 Gals. 32-36	Gasoline 10^2 Gals. 37-40	EVAPORATION Solvent Purchased tons yr 41-46	Gasoline Marketed 10^4 Gals. 47-51	MEASURED VEHICLE MILES Limited Access Road 10^4 Miles 52-57	Rural Roads 10^4 Miles 58-63	# GAS WELLS 64-69	Urban Roads 10^4 Miles 70-76	77	Action 78	79	cd 80
						702	186	160	2117	8291	24	3038		A	A	4

CUTBACK ASPHALT 100 lbs 10-16	NT GAS LEAKS 100 lbs 17-21	DRY CLN SOLVENT 100 lbs 22-26	PESTICIDE USE lbs 27-31	FOREST FIRES Area - Acres 32-38	Quant. ton/acre 39-41	MISC + SLASH BURNING Area - Acres 42-47	Quant. tons acre 48-50	OIL SLUDGE bbls. 51-54	55-57	Structure Fires #/year 58-61	# OIL WELLS 62-67	68-70	71-77	Action 78	79	cd 80
438	215	595	11700	240	9			1825		85	1982			A	A	5

COMMENTS 10-77	Action 78	79	cd 80
CREEK COUNTY 1977	A	A	6

EPA DUR. 219
3/72

AREA SOURCE
Input Form
Date ____________

Name of Person Completing Form G. T. Vinzani

State (1–2)	County (3–6)	AQCR (7–9)
37	0760	186

Year of Record (10–11)	EMISSION ESTIMATES (10^2 tons) Particulate (12–16)	SO_2 (17–21)	NO_x (22–25)	HC (26–30)	CO (31–35)	SULFUR CONTENT (%) Anth. Coal (36–37)	Bitum. Coal (38–39)	Dist. Oil (40–41)	Resid. Oil (42–43)	ASH CONTENT (%) Anth. Coal (44–46)	Bitum. Coal (47–49)	RESIDENTIAL FUEL Anth. 10^1 tons (50–53)	Bitumin. 10^1 tons (54–58)	Dist. Oil 10^4 Gal. (59–63)	Resid. Oil 10^4 Gal. (64–68)	Nat. Gas 10^7 ft.^{3} (69–73)	Wood 10^2 tons (74–77)	Action (78)	(79)	cd (80)
82																206		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL Anth. 10^1 tons (10–14)	Bitumin. 10^1 tons (15–19)	Dist. Oil 10^4 Gals. (20–24)	Resid. Oil 10^4 Gals. (25–29)	Nat. Gas 10^7 Ft^3 (30–33)	Wood 10^2 tons (34–35)	Anth. Coal 10^1 tons (36–41)	Bitum. Coal 10^1 tons (42–47)	OFF-HGWY GASOLINE Farm 10^3 gal (48–51)	Constr. 10^3 gal (52–56)	Sm. Engn. 10^3 gal. (57–61)	INDUST FUEL Nat. Gas 10^7 ft^3 (62–66)	OFF HGWY DIESEL Farm 10^3 gal (67–69)	Const. 10^4 gal (70–73)	(74–77)	Action (78)	(79)	cd (80)
				147				115	26	101		109	26		A	A	2

ON SITE INCINERATION Residential 10^1 tons (10–15)	Industrial 10^2 tons (16–20)	Comm. Inst. 10^2 tons (21–24)	OPEN BURNING Residential tons (25–30)	Industrial 10^2 tons (31–36)	Comm'l - Instit. 10^2 tons (37–42)	GASOLINE FUEL Light Vehicle 10^3 Gals. (43–49)	Heavy Vehicle 10^3 Gals. (50–54)	Off Hiway 10^3 Gals. (55–59)	DIESEL FUEL Heavy Vehicle 10^3 Gals. (60–64)	Off Hiway 10^4 Gals. (65–67)	Rail Locomotive 10^4 Gals. (68–72)	County Population 10^3 (73–76)	Dummy Col (77)	Action (78)	(79)	cd (80)
			10593								25	22		A	A	3

AIRCRAFT Military LTO CYC 10^2 (10–13)	Civil LTO CYC 10^1 (14–18)	Commercial LTO CYC 10^1 (19–23)	VESSELS Anth. Coal 10^1 tons (24–27)	Diesel Oil 10^4 Gals. (28–31)	Resid. Oil 10^4 Gals. (32–36)	Gasoline 10^2 Gals. (37–40)	EVAPORATION Solvent Purchased tons yr (41–46)	Gasoline Marketed 10^4 Gals. (47–51)	MEASURED VEHICLE MILES Limited Access Road 10^4 Miles (52–57)	Rural Roads 10^4 Miles (58–63)	# GAS WELLS (64–69)	Urban Roads 10^4 Miles (70–76)	(77)	Action (78)	(79)	cd (80)
						878	233	200	2392	9369	24	3433		A	A	4

CUTBACK ASPHALT 100 lbs (10–16)	NT GAS LEAKS 100 lbs (17–21)	DRY CLN SOLVENT 100 lbs (22–26)	PESTICIDE USE lbs (27–31)	FOREST FIRES Area - Acres (32–38)	Quant. ton/acre (39–41)	MISC + SLASH BURNING Area - Acres (42–47)	Quant. tons/acre (48–50)	OIL SLUDGE bbls. (51–54)	(55–57)	Structure Fires #/year (58–61)	# OIL WELLS (62–67)	(68–70)	(71–77)	Action (78)	(79)	cd (80)
496	184	637	14325	240	9			1825		88	1982			A	A	5

COMMENTS (10–77)	Action (78)	(79)	cd (80)
CREEK COUNTY 1982	A	A	6

EPA DUR 219
2/72

AREA SOURCE
Input Form
Date ________

Name of Person Completing Form G. T. Vinzani

State	County	AQCR
1 2	3 4 5 6	7 8 9
37	0760	186

Year of Record	EMISSION ESTIMATES (10² tons) Particulate	SO₂	NOₓ	HC	CO	SULFUR CONTENT (%) Anth. Coal	Bitum. Coal	Dist. Oil	Resid Oil	ASH CONTENT (%) Anth. Coal	Bitum. Coal	Anth. 10¹ tons	Bitumin. 10¹ tons	RESIDENTIAL FUEL Dist. Oil 10⁴ Gal.	Resid. Oil 10⁴ Gal.	Nat. Gas 10⁷ ft.³	Wood 10² tons	Action		cd
10 11	12 13 14 15 16	17 18 19 20 21	22 23 24 25	26 27 28 29 30	31 32 33 34 35	36 37	38 39	40 41	42 43	44 45 46	47 48 49	50 51 52 53	54 55 56 57 58	59 60 61 62 63	64 65 66 67 68	69 70 71 72 73	74 75 76 77	78	79	80
87																222		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL Anth. 10¹ tons	Bitumin. 10¹ tons	Dist. Oil 10⁴ Gals.	Resid. Oil 10⁴ Gals.	Nat. Gas 10⁷ Ft³	Wood 10² tons	Anth. Coal 10¹ tons	Bitum. Coal 10¹ tons	OFF-HGWY-GASOLINE Farm 10³ gal	Constr. 10³ gal	Sm. Engn. 10³ gal.	INDUST FUEL Nat. Gas 10⁷ ft³	OFF HGWY DIESEL Farm 10³ gal	Const. 10⁴ gal		Action		cd
10 11 12 13 14	15 16 17 18 19	20 21 22 23 24	25 26 27 28 29	30 31 32 33	34 35	36 37 38 39 40 41	42 43 44 45 46 47	48 49 50 51	52 53 54 55 56	57 58 59 60 61	62 63 64 65 66	67 68 69	70 71 72 73	74 75 76 77	78	79	80
				172				114	31	108		108	31		A	A	2

ON SITE INCINERATION Residential 10¹ tons	Industrial 10² tons	Comm. Inst. 10² tons	OPEN BURNING Residential tons	Industrial 10² tons	Comm'l-Instit. 10² tons	GASOLINE FUEL Light Vehicle 10³ Gals.	Heavy Vehicle 10³ Gals.	Off Hiway 10³ Gals.	DIESEL FUEL Heavy Vehicle 10³ Gals.	Off Hiway 10⁴ Gals.	Rail Locomotive 10⁴ Gals.	County Population 10³	Density Code	Action		cd
10 11 12 13 14 15	16 17 18 19 20	21 22 23 24	25 26 27 28 29 30	31 32 33 34 35 36	37 38 39 40 41 42	43 44 45 46 47 48 49	50 51 52 53 54	55 56 57 58 59	60 61 62 63 64	65 66 67	68 69 70 71 72	73 74 75 76	77	78	79	80
			11385								25	24		A	A	3

AIRCRAFT Military LTO CYC 10²	Civil LTO CYC 10¹	Commercial LTO CYC 10¹	VESSELS Anth. Coal 10¹ tons	Diesel Oil 10⁴ Gals.	Resid. Oil 10⁴ Gals.	Gasoline 10² Gals.	EVAPORATION Solvent Purchased tons yr	Gasoline Marketed 10⁴ Gals.	MEASURED VEHICLE MILES Limited Access Road 10⁴ Miles	Rural Roads 10⁴ Miles	# GAS WELLS	Urban Roads 10⁴ Miles		Action		cd
10 11 12 13	14 15 16 17 18	19 20 21 22 23	24 25 26 27	28 29 30 31	32 33 34 35 36	37 38 39 40	41 42 43 44 45 46	47 48 49 50 51	52 53 54 55 56 57	58 59 60 61 62 63	64 65 66 67 68 69	70 71 72 73 74 75 76	77	78	79	80
						1053	266	250	2710	10612	25	3889		A	A	4

CUTBACK ASPHALT 100 lbs	NT GAS LEAKS 100 lbs	DRY CLN SOLVENT 100 lbs	PESTICIDE USE lbs	FOREST FIRES Area - Acres	Quant. ton/acre	MISC + SLASH BURNING Area - Acres	Quant. tons acre	OIL SLUDGE bbls.		Structure Fires #/year	# OIL WELLS			Action		cd
10 11 12 13 14 15 16	17 18 19 20 21	22 23 24 25 26	27 28 29 30 31	32 33 34 35 36 37 38	39 40 41	42 43 44 45 46 47	48 49 50	51 52 53 54	55 56 57	58 59 60 61	62 63 64 65 66 67	68 69 70	71 72 73 74 75 76 77	78	79	80
561	124	684	17319	240	9			1825		96	2081			A	A	5

COMMENTS	Action		cd
10–77	78	79	80
CREEK COUNTY 1987	A	A	6

EPA DUR-219
2/72

AREA SOURCE
Input Form
Date ______

Name of Person Completing Form G. T. Vinzani

State 1-2	County 3-6	AQCR 7-9
37	2260	186

Year of Record 10-11	EMISSION ESTIMATES (10² tons) Particulate 12-16	SO₂ 17-21	NOₓ 22-25	HC 26-30	CO 31-35	SULFUR CONTENT (%) Anth. Coal 36-37	Bitum. Coal 38-39	Dist. Oil 40-41	Resid. Oil 42-43	ASH CONTENT (%) Anth. Coal 44-46	Bitum. Coal 47-49	RESIDENTIAL FUEL Anth. 10¹ tons 50-53	Bitumin. 10¹ tons 54-58	Dist. Oil 10⁴ Gal. 59-63	Resid. Oil 10⁴ Gal. 64-68	Nat Gas 10⁷ ft.³ 69-73	Wood 10² tons 74-77	Action 78	79	cd 80
77																133		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL Anth. 10¹ tons 10-14	Bitumin. 10¹ tons 15-19	Dist. Oil 10⁴ Gals. 20-24	Resid. Oil 10⁴ Gals. 25-29	Nat. Gas 10⁷ Ft³ 30-33	Wood 10² tons 34-35	Anth. Coal 10¹ tons 36-41	Bitum. Coal 10¹ tons 42-47	OFF-HGWY GASOLINE Farm 10³ gal 48-51	Constr. 10³ gal 52-56	Sm. Engn. 10³ gal. 57-61	INDUST FUEL Nat. Gas 10⁷ ft³ 62-66	OFF HGWY DIESEL Farm 10³ gal 67-69	Const. 10⁴ gal 70-73	74-77	Action 78	79	cd 80
				82				150	26	50		150	26		A	A	2

ON SITE INCINERATION Residential 10¹ tons 10-15	Industrial 10² tons 16-20	Comm. Inst. 10² tons 21-24	OPEN BURNING Residential tons 25-30	Industrial 10² tons 31-36	Comm'l Instit. 10² tons 37-42	GASOLINE FUEL Light Vehicle 10³ Gals. 43-49	Heavy Vehicle 10³ Gals. 50-54	Off Hiway 10³ Gals. 55-59	DIESEL FUEL Heavy Vehicle 10³ Gals. 60-64	Off Hiway 10⁴ Gals. 65-67	Rail Locomotive 10⁴ Gals. 68-72	County Population 10³ 73-76	[illegible] 77	Action 78	79	cd 80
			14945								35	11		A	A	3

AIRCRAFT Military LTO CYC 10² 10-13	Civil LTO CYC 10¹ 14-18	Commercial LTO CYC 10¹ 19-23	VESSELS Anth. Coal 10¹ tons 24-27	Diesel Oil 10⁴ Gals. 28-31	Resid. Oil 10⁴ Gals. 32-36	Gasoline 10² Gals. 37-40	EVAPORATION Solvent Purchased tons yr 41-46	Gasoline Marketed 10⁴ Gals. 47-51	MEASURED VEHICLE MILES Limited Access Road 10⁴ Miles 52-57	Rural Roads 10⁴ Miles 58-63	# GAS WELLS 64-69	Urban Roads 10⁴ Miles 70-76	77	Action 78	79	cd 80
						1535	1100	70	479	1780	8	360		A	A	4

CUTBACK ASPHALT 100 lbs 10-16	NT GAS LEAKS 100 lbs 17-21	DRY CLN SOLVENT 100 lbs 22-26	PESTICIDE USE lbs 27-31	FOREST FIRES Area - Acres 32-38	Quant. ton·acre 39-41	MISC + SLASH BURNING Area - Acres 42-47	Quant. tons acre 48-50	OIL SLUDGE bbls. 51-54	55-57	Structure Fires #/year 58-61	# OIL WELLS 62-67	68-70	71-77	Action 78	79	cd 80
88	115	319	30100	250	9	2500	3			46	2186			A	A	5

COMMENTS 10-77	Action 78	79	cd 80
OSAGE COUNTY 1977	A	A	6

EPA DUR 219
3/72

AREA SOURCE
Input Form
Date ____________

Name of Person Completing Form G. T. Vinzani

State		County				AQCR		
1	2	3	4	5	6	7	8	9
3	7	2	2	6	0	1	8	6

Year of Record	EMISSION ESTIMATES (10² tons) Particulate	SO₂	NOₓ	HC	CO	SULFUR CONTENT (%) Anth. Coal	Bitum. Coal	Dist. Oil	Resid Oil	ASH CONTENT (%) Anth. Coal	Bilum. Coal	RESIDENTIAL FUEL Anth. 10¹ tons	Bitumin. 10¹ tons	Dist. Oil 10⁴ Gal.	Resid. Oil 10⁴ Gal.	Nat. Gas 10⁷ ft.³	Wood 10² tons	Action		cd
10 11	12 13 14 15 16	17 18 19 20 21	22 23 24 25	26 27 28 29 30	31 32 33 34 35	36 37	38 39	40 41	42 43	44 45 46	47 48 49	50 51 52 53	54 55 56 57 58	59 60 61 62 63	64 65 66 67 68	69 70 71 72 73	74 75 76 77	78	79	80
82																138		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL Anth. 10¹ tons	Bitumin. 10¹ tons	Dist. Oil 10⁴ Gals.	Resid. Oil 10⁴ Gals.	Nat. Gas 10⁷ Ft³	Wood 10² tons	Anth. Coal 10¹ tons	Bitum. Coal 10¹ tons	OFF-HGWY GASOLINE Farm 10³ gal	Constr. 10³ gal	Sm. Engn. 10³ gal.	INDUST FUEL Nat. Gas 10⁷ ft³	OFF HGWY DIESEL Farm 10³ gal	Const. 10⁴ gal		Action		cd
10 11 12 13 14	15 16 17 18 19	20 21 22 23 24	25 26 27 28 29	30 31 32 33	34 35	36 37 38 39 40 41	42 43 44 45 46 47	48 49 50 51	52 53 54 55 56	57 58 59 60 61	62 63 64 65 66	67 68 69	70 71 72 73	74 75 76 77	78	79	80
				85				1.42	32	52		142	32		A	A	2

ON SITE INCINERATION Residential 10¹ tons	Industrial 10² tons	Comm. Inst. 10² tons	OPEN BURNING Residential tons	Industrial 10² tons	Comm'l-Instit. 10² tons	GASOLINE FUEL Light Vehicle 10³ Gals.	Heavy Vehicle 10³ Gals.	Off Hiway 10³ Gals.	DIESEL FUEL Heavy Vehicle 10³ Gals.	Off Hiway 10⁴ Gals.	Rail Locomotive 10⁴ Gals.	County Population 10³	[illegible]	Action		cd
10 11 12 13 14 15	16 17 18 19 20	21 22 23 24	25 26 27 28 29 30	31 32 33 34 35 36	37 38 39 40 41 42	43 44 45 46 47 48 49	50 51 52 53 54	55 56 57 58 59	60 61 62 63 64	65 66 67	68 69 70 71 72	73 74 75 76	77	78	79	80
			15483								35	11		A	A	3

AIRCRAFT Military LTO CYC 10²	Civil LTO CYC 10¹	Commercial LTO CYC 10¹	VESSELS Anth. Coal 10¹ tons	Diesel Oil 10⁴ Gals.	Resid. Oil 10⁴ Gals.	Gasoline 10² Gals.	EVAPORATION Solvent Purchased tons yr	Gasoline Marketed 10⁴ Gals.	MEASURED VEHICLE MILES Limited Access Road 10⁴ Miles	Rural Roads 10⁴ Miles	# GAS WELLS	Urban Roads 10⁴ Miles		Action		cd
10 11 12 13	14 15 16 17 18	19 20 21 22 23	24 25 26 27	28 29 30 31	32 33 34 35 36	37 38 39 40	41 42 43 44 45 46	47 48 49 50 51	52 53 54 55 56 57	58 59 60 61 62 63	64 65 66 67 68 69	70 71 72 73 74 75 76	77	78	79	80
						1919	1126	90	541	2011	9	346		A	A	4

CUTBACK ASPHALT 100 lbs	NT GAS LEAKS 100 lbs	DRY CLN SOLVENT 100 lbs	PESTICIDE USE lbs	FOREST FIRES Area - Acres	Quant. ton/acre	MISC + SLASH BURNING Area - Acres	Quant. tons acre	OIL SLUDGE bbls.		Structure Fires #/year	# OIL WELLS			Action		cd
10 11 12 13 14 15 16	17 18 19 20 21	22 23 24 25 26	27 28 29 30 31	32 33 34 35 36 37 38	39 40 41	42 43 44 45 46 47	48 49 50	51 52 53 54	55 56 57	58 59 60 61	62 63 64 65 66 67	68 69 70	71 72 73 74 75 76 77	76	75	00
100	95	330	42217	250	9	2500	3			44	2534			A	A	5

COMMENTS	Action		cd
10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77	78	79	80
OSAGE COUNTY 1982	A	A	6

EPA DUR 219
3/72

AREA SOURCE
Input Form
Date ______

Name of Person Completing Form G. T. Vinzani

State (1-2)	County (3-6)	AQCR (7-9)
37	2260	186

Year of Record (10-11)	EMISSION ESTIMATES (10² tons) Particulate (12-16)	SO$_2$ (17-21)	NO$_x$ (22-25)	HC (26-30)	CO (31-35)	SULFUR CONTENT (%) Anth. Coal (36-37)	Bitum. Coal (38-39)	Dist. Oil (40-41)	Resid Oil (42-43)	ASH CONTENT (%) Anth. Coal (44-46)	Bitum. Coal (47-49)	RESIDENTIAL FUEL Anth. 10¹ tons (50-53)	Bitumin. 10¹ tons (54-58)	Dist. Oil 10⁴ Gal. (59-63)	Resid. Oil 10⁴ Gal. (64-68)	Nat. Gas 10⁷ ft.³ (69-73)	Wood 10² tons (74-77)	Action (78)	(79)	cd (80)
87																143		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL Anth. 10¹ tons (10-14)	Bitumin. 10¹ tons (15-19)	Dist. Oil 10⁴ Gals. (20-24)	Resid. Oil 10⁴ Gals. (25-29)	Nat. Gas 10⁷ Ft³ (30-33)	Wood 10² tons (34-35)	Anth. Coal 10¹ tons (36-41)	Bitum. Coal 10¹ tons (42-47)	OFF-HGWY GASOLINE Farm 10³ gal (48-51)	Constr. 10³ gal (52-56)	Sm. Engn. 10³ gal. (57-61)	INDUST FUEL Nat. Gas 10⁷ ft³ (62-66)	OFF HGWY DIESEL Farm 10³ gal (67-69)	Const. 10⁴ gal (70-73)	(74-77)	Action (78)	(79)	cd (80)
				119				129	38	54		129	38		A	A	2

ON SITE INCINERATION Residential 10¹ tons (10-15)	Industrial 10² tons (16-20)	Comm. Inst. 10² tons (21-24)	OPEN BURNING Residential tons (25-30)	Industrial 10² tons (31-36)	Comm'l - Instl. 10² tons (37-42)	GASOLINE FUEL Light Vehicle 10³ Gals. (43-49)	Heavy Vehicle 10³ Gals. (50-54)	Off Hiway 10³ Gals. (55-59)	DIESEL FUEL Heavy Vehicle 10³ Gals. (60-64)	Off Hiway 10⁴ Gals. (65-67)	Rail Locomotive 10⁴ Gals. (68-72)	County Population 10³ (73-76)	Density Code (77)	Action (78)	(79)	cd (80)
			16066								35	12		A	A	3

AIRCRAFT Military LTO CYC 10² (10-13)	Civil LTO CYC 10¹ (14-18)	Commercial LTO CYC 10¹ (19-23)	VESSELS Anth. Coal 10¹ tons (24-27)	Diesel Oil 10⁴ Gals. (28-31)	Resid. Oil 10⁴ Gals. (32-36)	Gasoline 10² Gals. (37-40)	EVAPORATION Solvent Purchased tons yr (41-46)	Gasoline Marketed 10⁴ Gals. (47-51)	MEASURED VEHICLE MILES Limited Access Road 10⁴ Miles (52-57)	Rural Roads 10⁴ Miles (58-63)	# GAS WELLS (64-69)	Urban Roads 10⁴ Miles (70-76)	(77)	Action (78)	(79)	cd (80)
						2302	142	110	613	2278	11	461		A	A	4

CUTBACK ASPHALT 100 lbs (10-16)	NT GAS LEAKS 100 lbs (17-21)	DRY CLN SOLVENT 100 lbs (22-26)	PESTICIDE USE lbs (27-31)	FOREST FIRES Area - Acres (32-38)	Quant. ton/acre (39-41)	MISC + SLASH BURNING Area - Acres (42-47)	Quant. tons acre (48-50)	OIL SLUDGE bbls. (51-54)	(55-57)	Structure Fires #/year (58-61)	# OIL WELLS (62-67)	(68-77)	Action (78)	(79)	cd (80)
113	62	343	59211	250	9	2500	3			48	2938		A	A	5

COMMENTS (10-77)	Action (78)	(79)	cd (80)
OSAGE COUNTY 1987	A	A	6

EPA DUR 219
1/72

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Input Form
Date ________

Name of Person Completing Form G. T. Vinzani

State		County				AQCR		
1	2	3	4	5	6	7	8	9
3	7	1	9	8	0	1	8	6

Year of Record	EMISSION ESTIMATES (10^2 tons) Particulate	SO$_2$	NO$_x$	HC	CO	SULFUR CONTENT (%) Anth. Coal	Bitum. Coal	Dist. Oil	Resid. Oil	ASH CONTENT (%) Anth. Coal	Bitum. Coal	RESIDENTIAL FUEL Anth. 10^1 tons	Bitumin. 10^1 tons	Dist. Oil 10^4 Gal.	Resid. Oil 10^4 Gal.	Nat. Gas 10^7 ft.^{3}	Wood 10^2 tons	Action		cd
10–11	12–16	17–21	22–25	26–30	31–35	36–37	38–39	40–41	42–43	44–46	47–49	50–53	54–58	59–63	64–68	69–73	74–77	78	79	80
77																158		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL Anth. 10^1 tons	Bitumin. 10^1 tons	Dist. Oil 10^4 Gals.	Resid. Oil 10^4 Gals.	Nat. Gas 10^7 Ft^3	Wood 10^2 tons	Anth. Coal 10^1 tons	Bitum. Coal 10^1 tons	OFF-HGWY GASOLINE Farm 10^3 gal	Constr. 10^3 gal	Sm. Engn. 10^3 gal.	INDUST FUEL Nat. Gas 10^7 ft^3	OFF HGWY DIESEL Farm 10^3 gal	Const. 10^4 gal		Action		cd
10–14	15–19	20–24	25–29	30–33	34–35	36–41	42–47	48–51	52–56	57–61	62–66	67–69	70–73	74–77	78	79	80
				97					30	182	402		30		A	A	2

ON SITE INCINERATION Residential 10^1 tons	Industrial 10^2 tons	Comm. Inst. 10^2 tons	OPEN BURNING Residential tons	Industrial 10^2 tons	Comm'l-Instit. 10^2 tons	GASOLINE FUEL Light Vehicle 10^3 Gals.	Heavy Vehicle 10^3 Gals.	Off Hiway 10^3 Gals.	DIESEL FUEL Heavy Vehicle 10^3 Gals.	Off Hiway 10^4 Gals.	Rail Locomotive 10^4 Gals.	County Population 10^3	[illegible]	Action		cd
10–15	16–20	21–24	25–30	31–36	37–42	43–49	50–54	55–59	60–64	65–67	68–72	73–76	77	78	79	80
		9										41		A	A	3

AIRCRAFT Military LTO CYC 10^2	Civil LTO CYC 10^1	Commercial LTO CYC 10^1	VESSELS Anth. Coal 10^1 tons	Diesel Oil 10^4 Gals.	Resid. Oil 10^4 Gals.	Gasoline 10^2 Gals.	EVAPORATION Solvent Purchased tons yr	Gasoline Marketed 10^4 Gals.	MEASURED VEHICLE MILES Limited Access Road 10^4 Miles	Rural Roads 10^4 Miles	# GAS WELLS	Urban Roads 10^4 Miles		Action		cd
10–13	14–18	19–23	24–27	28–31	32–36	37–40	41–46	47–51	52–57	58–63	64–69	70–76	77	78	79	80
							361	4200	10646	3493		44813		A	A	4

CUTBACK ASPHALT 100 lbs	NT GAS LEAKS 100 lbs	DRY CLN SOLVENT 100 lbs	PESTICIDE USE lbs	FOREST FIRES Area - Acres	Quant. ton/acre	MISC + SLASH BURNING Area - Acres	Quant. tons acre	OIL SLUDGE bbls.		Structure Fires #/year	# OIL WELLS			Action		cd
10–16	17–21	22–26	27–31	32–38	39–41	42–47	48–50	51–54	55–57	58–61	62–67	68–70	71–77	78	79	80
1989	416	994								165				A	A	5

COMMENTS	Action		cd
10–77	78	79	80
CITY OF MUSKOGEE 1977	A	A	6

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Name of Person Completing Form G. T. Vinzant

State	County	AQCR
37	1980	186

Year of Record	EMISSION ESTIMATES (10² tons) Particulate	SO₂	NOₓ	HC	CO	SULFUR CONTENT (%) Anth. Coal	Bitum. Coal	Dist. Oil	Resid. Oil	ASH CONTENT (%) Anth. Coal	Bitum. Coal	RESIDENTIAL FUEL Anth. 10¹ tons	Bitumin. 10¹ tons	Dist. Oil 10⁴ Gal.	Resid. Oil 10⁴ Gal.	Nat. Gas 10⁷ ft.³	Wood 10² tons	Action		cd
82																173		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL Anth. 10¹ tons	Bitumin. 10¹ tons	Dist. Oil 10⁴ Gals.	Resid. Oil 10⁴ Gals.	Nat. Gas 10⁷ Ft³	Wood 10² tons	Anth. Coal 10¹ tons	Bitum. Coal 10¹ tons	OFF-HGWY GASOLINE Farm 10³ gal	Constr. 10³ gal	Sm. Engn. 10³ gal.	INDUST FUEL Nat. Gas 10⁷ ft³	OFF HGWY DIESEL Farm 10³ gal	Const. 10⁴ gal		Action		cd
				118					37	199	490		37		A	A	2

ON SITE INCINERATION Residential 10¹ tons	Industrial 10² tons	Comm. Inst. 10² tons	OPEN BURNING Residential tons	Industrial 10² tons	Comm'l Instit. 10² tons	GASOLINE FUEL Light Vehicle 10³ Gals.	Heavy Vehicle 10³ Gals.	Off Hiway 10³ Gals.	DIESEL FUEL Heavy Vehicle 10³ Gals.	Off Hiway 10⁴ Gals.	Rail Locomotive 10⁴ Gals.	County Population 10³	8 County Code	Action		cd
		7										45		A	A	3

AIRCRAFT Military LTO CYC 10²	Civil LTO CYC 10¹	Commercial LTO CYC 10¹	VESSELS Anth. Coal 10¹ tons	Diesel Oil 10⁴ Gals.	Resid. Oil 10⁴ Gals.	Gasoline 10² Gals.	EVAPORATION Solvent Purchased tons yr	Gasoline Marketed 10⁴ Gals.	MEASURED VEHICLE MILES Limited Access Road 10⁴ Miles	Rural Roads 10⁴ Miles	# GAS WELLS	Urban Roads 10⁴ Miles		Action		cd
							453	5200	12030	3947		50639		A	A	4

CUTBACK ASPHALT 100 lbs	NT GAS LEAKS 100 lbs	DRY CLN SOLVENT 100 lbs	PESTICIDE USE lbs	FOREST FIRES Area - Acres	Quant. ton/acre	MISC + SLASH BURNING Area - Acres	Quant. tons acre	OIL SLUDGE bbls.		Structure Fires #/year	# OIL WELLS			Action		cd
2250	364	1087								180				A	A	5

COMMENTS	Action		cd
CITY OF MUSKOGEE 1982	A	A	[illegible]

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AREA SOURCE
Input Form
Date ______

Name of Person Completing Form G. T. Vinzani

State		County				AQCR		
1	2	3	4	5	6	7	8	9
3	7	1	9	8	0	1	8	6

	Year of Record	10–11	87
EMISSION ESTIMATES (10² tons)	Particulate	12–16	
	SO$_2$	17–21	
	NO$_x$	22–25	
	HC	26–30	
	CO	31–35	
SULFUR CONTENT (%)	Anth. Coal	36–37	
	Bitum. Coal	38–39	
	Dist. Oil	40–41	
	Resid. Oil	42–43	
ASH CONTENT (%)	Anth. Coal	44–46	
	Bitum. Coal	47–49	
RESIDENTIAL FUEL	Anth. 10¹ tons	50–53	
	Bitumin. 10¹ tons	54–58	
	Dist. Oil 10⁴ Gal.	59–63	
	Resid. Oil 10⁴ Gal.	64–68	
	Nat. Gas 10⁷ ft.³	69–73	189
	Wood 10² tons	74–77	
	Action	78	A
		79	A
	cd	80	1

COMMERCIAL AND INSTITUTIONAL FUEL	Anth. 10¹ tons	10–14	
	Bitumin. 10¹ tons	15–19	
	Dist. Oil 10⁴ Gals.	20–24	
	Resid. Oil 10⁴ Gals.	25–29	
	Nat. Gas 10⁷ Ft³	30–33	140
	Wood 10² tons	34–35	
	Anth. Coal 10¹ tons	36–41	
	Bitum. Coal 10¹ tons	42–47	
OFF-HGWY·GASOLINE	Farm 10³ gal	48–51	
	Constr. 10³ gal	52–56	44
	Sm. Engn. 10³ gal.	57–61	218
INDUST FUEL	Nat. Gas 10⁷ ft³	62–66	581
OFF HGWY DIESEL	Farm 10³ gal	67–69	
	Const. 10⁴ gal	70–73	44
		74–77	
	Action	78	A
		79	A
	cd	80	2

ON SITE INCINERATION	Residential 10¹ tons	10–15	
	Industrial 10² tons	16–20	
	Comm. Inst. 10² tons	21–24	5
OPEN BURNING	Residential tons	25–30	
	Industrial 10² tons	31–36	
	Comm'l - Instl. 10² tons	37–42	
GASOLINE FUEL	Light Vehicle 10³ Gals.	43–49	
	Heavy Vehicle 10³ Gals.	50–54	
	Off Hiway 10³ Gals.	55–59	
DIESEL FUEL	Heavy Vehicle 10³ Gals.	60–64	
	Off Hiway 10⁴ Gals.	65–67	
	Rail Locomotive 10⁴ Gals.	68–72	
	County Population 10³	73–76	49
	Density Code	77	
	Action	78	A
		79	A
	cd	80	3

AIRCRAFT	Military LTO CYC 10²	10–13	
	Civil LTO CYC 10¹	14–18	
	Commercial LTO CYC 10¹	19–23	
VESSELS	Anth. Coal 10¹ tons	24–27	
	Diesel Oil 10⁴ Gals.	28–31	
	Resid. Oil 10⁴ Gals.	32–36	
	Gasoline 10² Gals.	37–40	
EVAPORATION	Solvent Purchased tons yr	41–46	5118
	Gasoline Marketed 10⁴ Gals.	47–51	6460
MEASURED VEHICLE MILES	Limited Access Road 10⁴ Miles	52–57	13627
	Rural Roads 10⁴ Miles	58–63	4471
	# GAS WELLS	64–69	
	Urban Roads 10⁴ Miles	70–76	57631
		77	
	Action	78	A
		79	A
	cd	80	4

CUTBACK ASPHALT	100 lbs	10–16	2546
NT GAS LEAKS	100 lbs	17–21	250
DRY CLN SOLVENT	100 lbs	22–26	1193
PESTICIDE USE	lbs	27–31	
FOREST FIRES	Area - Acres	32–38	
	Quant. ton/acre	39–41	
MISC + SLASH BURNING	Area - Acres	42–47	
	Quant. tons acre	48–50	
OIL SLUDGE	bbls.	51–54	
		55–57	
Structure Fires	#/year	58–61	196
# OIL WELLS		62–67	
		68–77	
	Action	78	A
		79	A
	cd	80	5

COMMENTS	10–77	CITY OF MUSKOGEE 1987
Action	78	A
	79	A
cd	80	6

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Date ____________

Name of Person Completing Form G. T. Vinzani

State	County	AQCR
1 2	3 4 5 6	7 8 9
3 7	0 2 0 0	1 8 6

Year of Record	EMISSION ESTIMATES (10^2 tons) Particulate	SO$_2$	NO$_x$	HC	CO	SULFUR CONTENT (%) Anth. Coal	Bitum. Coal	Dist. Oil	Resid Oil	ASH CONTENT (%) Anth. Coal	Bitum. Coal	RESIDENTIAL FUEL Anth. 10^1 tons	Bitumin. 10^1 tons	Dist. Oil 10^4 Gal.	Resid. Oil 10^4 Gal.	Nat. Gas 10^7 ft.^{3}	Wood 10^2 tons	Action		cd
10 11	12 13 14 15 16	17 18 19 20 21	22 23 24 25	26 27 28 29 30	31 32 33 34 35	36 37	38 39	40 41	42 43	44 45 46	47 48 49	50 51 52 53	54 55 56 57 58	59 60 61 62 63	64 65 66 67 68	69 70 71 72 73	74 75 76 77	78	79	80
77																117		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL Anth. 10^1 tons	Bitumin. 10^1 tons	Dist. Oil 10^4 Gals.	Resid. Oil 10^4 Gals.	Nat. Gas 10^7 Ft^3	Wood 10^2tons	Anth. Coal 10^1 tons	Bitum. Coal 10^1 tons	OFF-HGWY GASOLINE Farm 10^3 gal	Constr. 10^3 gal	Sm. Engn. 10^3 gal.	INDUST FUEL Nat. Gas 10^7 ft^3	OFF HGWY DIESEL Farm 10^3 gal	Const. 10^4 gal		Action		cd
10 11 12 13 14	15 16 17 18 19	20 21 22 23 24	25 26 27 28 29	30 31 32 33	34 35	36 37 38 39 40 41	42 43 44 45 46 47	48 49 50 51	52 53 54 55 56	57 58 59 60 61	62 63 64 65 66	67 68 69	70 71 72 73	74 75 76 77	78	79	80
				72					60	135			60		A	A	2

ON SITE INCINERATION Residential 10^1 tons	Industrial 10^2 tons	Comm. Inst. 10^2 tons	OPEN BURNING Residential tons	Industrial 10^2 tons	Comm'l - Instit. 10^2 tons	GASOLINE FUEL Light Vehicle 10^3 Gals.	Heavy Vehicle 10^3 Gals.	Off Hiway 10^3 Gals.	DIESEL FUEL Heavy Vehicle 10^3 Gals.	Off Hiway 10^4 Gals.	Rail Locomotive 10^4 Gals.	County Population 10^3	Density Code	Action		cd
10 11 12 13 14 15	16 17 18 19 20	21 22 23 24	25 26 27 28 29 30	31 32 33 34 35 36	37 38 39 40 41 42	43 44 45 46 47 48 49	50 51 52 53 54	55 56 57 58 59	60 61 62 63 64	65 66 67	68 69 70 71 72	73 74 75 76	77	78	79	80
		7										31		A	A	3

AIRCRAFT Military LTO CYC 10^2	Civil LTO CYC 10^1	Commercial LTO CYC 10^1	VESSELS Anth. Coal 10^1 tons	Diesel Oil 10^4 Gals.	Resid. Oil 10^4 Gals.	Gasoline 10^2 Gals.	EVAPORATION Solvent Purchased tons yr	Gasoline Marketed 10^4 Gals.	MEASURED VEHICLE MILES Limited Access Road 10^4 Miles	Rural Roads 10^4 Miles	# GAS WELLS	Urban Roads 10^4 Miles		Action		cd
10 11 12 13	14 15 16 17 18	19 20 21 22 23	24 25 26 27	28 29 30 31	32 33 34 35 36	37 38 39 40	41 42 43 44 45 46	47 48 49 50 51	52 53 54 55 56 57	58 59 60 61 62 63	64 65 66 67 68 69	70 71 72 73 74 75 76	77	78	79	80
							268	3460				48471		A	A	4

CUTBACK ASPHALT 100 lbs	NT GAS LEAKS 100 lbs	DRY CLN SOLVENT 100 lbs	PESTICIDE USE lbs	FOREST FIRES Area - Acres	Quant. ton/acre	MISC + SLASH BURNING Area - Acres	Quant. tons acre	OIL SLUDGE bbls.		Structure Fires #/year	# OIL WELLS			Action		cd
10 11 12 13 14 15 16	17 18 19 20 21	22 23 24 25 26	27 28 29 30 31	32 33 34 35 36 37 38	39 40 41	42 43 44 45 46 47	48 49 50	51 52 53 54	55 56 57	58 59 60 61	62 63 64 65 66 67	68 69 70	71 72 73 74 75 76 77	78	79	80
1618	309	951								123	100			A	A	6

COMMENTS	Action		cd
10–77	78	79	80
CITY OF BARTLESVILLE 1977	A	A	6

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Input Form
Date ________

Name of Person Completing Form G. T. Vinzani

State	State	County	County	County	County	AQCR	AQCR	AQCR
1	2	3	4	5	6	7	8	9
3	7	0	2	0	0	1	8	6

	EMISSION ESTIMATES (10² tons)					SULFUR CONTENT (%)				ASH CONTENT (%)		RESIDENTIAL FUEL								
Year of Record	Particulate	SO$_2$	NO$_x$	HC	CO	Anth. Coal	Bitum. Coal	Dist. Oil	Resid. Oil	Anth. Coal	Bitum. Coal	Anth. 10¹ tons	Bitumin. 10¹ tons	Dist. Oil 10⁴ Gal.	Resid. Oil 10⁴ Gal.	Nat. Gas 10⁷ ft.³	Wood 10² tons	Action		cd
10–11	12–16	17–21	22–25	26–30	31–35	36–37	38–39	40–41	42–43	44–46	47–49	50–53	54–58	59–63	64–68	69–73	74–77	78	79	80
82																122		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL								OFF-HGWY GASOLINE			INDUST FUEL	OFF HGWY DIESEL					
Anth. 10¹ tons	Bitumin. 10¹ tons	Dist. Oil 10⁴ Gals.	Resid. Oil 10⁴ Gals.	Nat. Gas 10⁷ Ft³	Wood 10² tons	Anth. Coal 10¹ tons	Bitum. Coal 10¹ tons	Farm 10³ gal	Constr. 10³ gal	Sm. Engn. 10³ gal.	Nat. Gas 10⁷ ft³	Farm 10³ gal	Const. 10⁴ gal		Action		cd
10–14	15–19	20–24	25–29	30–33	34–35	36–41	42–47	48–51	52–56	57–61	62–66	67–69	70–73	74–77	78	79	80
				89					74	141			24		A	A	2

ON SITE INCINERATION			OPEN BURNING			GASOLINE FUEL			DIESEL FUEL							
Residential 10¹ tons	Industrial 10² tons	Comm. Inst. 10² tons	Residential tons	Industrial 10² tons	Comm'l - Instl. 10² tons	Light Vehicle 10³ Gals.	Heavy Vehicle 10³ Gals.	Off Hiway 10³ Gals.	Heavy Vehicle 10³ Gals.	Off Hiway 10⁴ Gals.	Rail Locomotive 10⁶ Gals.	County Population 10³	Density Cd	Action		cd
10–15	16–20	21–24	25–30	31–36	37–42	43–49	50–54	55–59	60–64	65–67	68–72	73–76	77	78	79	80
		5										37		A	A	3

AIRCRAFT			VESSELS				EVAPORATION		MEASURED VEHICLE MILES							
Military LTO CYC 10²	Civil LTO CYC 10¹	Commercial LTO CYC 10¹	Anth. Coal 10¹ tons	Diesel Oil 10⁴ Gals.	Resid. Oil 10⁴ Gals.	Gasoline 10² Gals.	Solvent Purchased tons yr	Gasoline Marketed 10⁴ Gals.	Limited Access Road 10⁴ Miles	Rural Roads 10⁴ Miles	# GAS WELLS	Urban Roads 10⁴ Miles		Action		cd
10–13	14–18	19–23	24–27	28–31	32–36	37–40	41–46	47–51	52–57	58–63	64–69	70–76	77	78	79	80
							336	4300				54772		A	A	4

				FOREST FIRES		MISC + SLASH BURNING									
CUTBACK ASPHALT 100 lbs	NT GAS LEAKS 100 lbs	DRY CLN SOLVENT 100 lbs	PESTICIDE USE lbs	Area - Acres	Quant. ton/acre	Area - Acres	Quant. tons acre	OIL SLUDGE bbls.		Structure Fires #/year	# OIL WELLS		Action		cd
10–16	17–21	22–26	27–31	32–38	39–41	42–47	48–50	51–54	55–57	58–61	62–67	68–77	78	79	80
1831	258	991								148	100		A	A	5

COMMENTS	Action		cd
10–77	78	79	80
CITY OF BARTLESVILLE 1982	A	A	6

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Input Form
Date ____________

Name of Person Completing Form G. T. Vinzani ____________

State 1	State 2	County 3	County 4	County 5	County 6	AQCR 7	AQCR 8	AQCR 9
3	7	0	2	0	0	1	8	6

Group	Field	Columns	Entry
	Year of Record	10–11	87
EMISSION ESTIMATES (10² tons)	Particulate	12–16	
	SO₂	17–21	
	NOₓ	22–25	
	HC	26–30	
	CO	31–35	
SULFUR CONTENT (%)	Anth. Coal	36–37	
	Bitum. Coal	38–39	
	Dist. Oil	40–41	
	Resid Oil	42–43	
ASH CONTENT (%)	Anth. Coal	44–46	
	Bitum. Coal	47–49	
RESIDENTIAL FUEL	Anth. 10¹ tons	50–53	
	Bitumin. 10¹ tons	54–58	
	Dist. Oil 10⁴ Gal.	59–63	
	Resid. Oil 10⁴ Gal.	64–68	
	Nat. Gas 10⁷ ft.³	69–73	126
	Wood 10² tons	74–77	
	Action	78	A
		79	A
	cd	80	1

Group	Field	Columns	Entry
COMMERCIAL AND INSTITUTIONAL FUEL	Anth. 10¹ tons	10–14	
	Bitumin. 10¹ tons	15–19	
	Dist. Oil 10⁴ Gals.	20–24	
	Resid. Oil 10⁴ Gals.	25–29	
	Nat. Gas 10⁷ Ft³	30–33	104
	Wood 10² tons	34–35	
	Anth. Coal 10¹ tons	36–41	
	Bitum. Coal 10¹ tons	42–47	
OFF-HGWY GASOLINE	Farm 10³ gal	48–51	
	Constr. 10³ gal	52–56	88
	Sm. Engn. 10³ gal.	57–61	146
INDUST FUEL	Nat. Gas 10⁷ ft³	62–66	
OFF HGWY DIESEL	Farm 10³ gal	67–69	
	Const. 10⁴ gal	70–73	88
		74–77	
	Action	78	A
		79	A
	cd	80	2

Group	Field	Columns	Entry
ON SITE INCINERATION	Residential 10¹ tons	10–15	
	Industrial 10² tons	16–20	
	Comm. Inst. 10² tons	21–24	4
OPEN BURNING	Residential tons	25–30	
	Industrial 10² tons	31–36	
	Comm'l-Instit'l. 10² tons	37–42	
GASOLINE FUEL	Light Vehicle 10³ Gals.	43–49	
	Heavy Vehicle 10³ Gals.	50–54	
	Off Hiway 10³ Gals.	55–59	
DIESEL FUEL	Heavy Vehicle 10³ Gals.	60–64	
	Off Hiway 10⁴ Gals.	65–67	
	Rail Locomotive 10⁴ Gals.	68–72	
	County Population 10³	73–76	33
	Density Code	77	
	Action	78	A
		79	A
	cd	80	3

Group	Field	Columns	Entry
AIRCRAFT	Military LTO CYC 10²	10–13	
	Civil LTO CYC 10¹	14–18	
	Commercial LTO CYC 10¹	19–23	
VESSELS	Anth. Coal 10¹ tons	24–27	
	Diesel Oil 10⁴ Gals.	28–31	
	Resid. Oil 10⁴ Gals.	32–36	
	Gasoline 10² Gals.	37–40	
EVAPORATION	Solvent Purchased tons yr	41–46	383
	Gasoline Marketed 10⁴ Gals.	47–51	5320
MEASURED VEHICLE MILES	Limited Access Road 10⁴ Miles	52–57	
	Rural Roads 10⁴ Miles	58–63	
	# GAS WELLS	64–69	
	Urban Roads 10⁴ Miles	70–76	62043
		77	
	Action	78	A
		79	A
	cd	80	4

Group	Field	Columns	Entry
CUTBACK ASPHALT	100 lbs	10–16	2071
NT GAS LEAKS	100 lbs	17–21	167
DRY CLN SOLVENT	100 lbs	22–26	1025
PESTICIDE USE	lbs	27–31	
FOREST FIRES	Area - Acres	32–38	
	Quant. ton/acre	39–41	
MISC + SLASH BURNING	Area - Acres	42–47	
	Quant. tons/acre	48–50	
OIL SLUDGE	bbls.	51–54	
		55–57	
	Structure Fires N/year	58–61	132
	# OIL WELLS	62–67	105
		68–70	
		71–77	
	Action	78	A
		79	A
	cd	80	5

Group	Field	Columns	Entry
COMMENTS		10–77	CITY OF BARTLESVILLE 1987
	Action	78	A
		79	A
	cd	80	6

EPA DUR. 219
3/72

AREA SOURCE
Input Form
Date ____________

Name of Person Completing Form: G. T. Vinzani

State (1–2)	County (3–6)	AQCR (7–9)
37	3140	186

Year of Record (10–11)	EMISSION ESTIMATES (10² tons) Particulate (12–16)	SO_2 (17–21)	NO_x (22–25)	HC (26–30)	CO (31–35)	SULFUR CONTENT (%) Anth. Coal (36–37)	Bitum. Coal (38–39)	Dist. Oil (40–41)	Resid. Oil (42–43)	ASH CONTENT (%) Anth. Coal (44–46)	Bitum. Coal (47–49)	RESIDENTIAL FUEL Anth. 10¹ tons (50–53)	Bitumin. 10¹ tons (54–58)	Dist. Oil 10⁴ Gal. (59–63)	Resid. Oil 10⁴ Gal. (64–68)	Nat. Gas 10⁷ ft.³ (69–73)	Wood 10² tons (74–77)	Action (78)	(79)	cd (80)
77																182		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL Anth. 10¹ tons (10–14)	Bitumin. 10¹ tons (15–19)	Dist. Oil 10⁴ Gals. (20–24)	Resid. Oil 10⁴ Gals. (25–29)	Nat. Gas 10⁷ Ft³ (30–33)	Wood 10² tons (34–35)	Anth. Coal 10¹ tons (36–41)	Bitum. Coal 10¹ tons (42–47)	OFF-HGWY GASOLINE Farm 10³ gal (48–51)	Constr. 10³ gal (52–56)	Sm. Engn. 10³ gal. (57–61)	INDUST FUEL Nat. Gas 10⁷ ft³ (62–66)	OFF HGWY DIESEL Farm 10³ gal (67–69)	Const. 10⁴ gal (70–73)	(74–77)	Action (78)	(79)	cd (80)
				112				125	20	32		109	20		A	A	2

ON SITE INCINERATION Residential 10¹ tons (10–15)	Industrial 10² tons (16–20)	Comm. Inst. 10² tons (21–24)	OPEN BURNING Residential tons (25–30)	Industrial 10² tons (31–36)	Comm'l-Instit. 10² tons (37–42)	GASOLINE FUEL Light Vehicle 10³ Gals. (43–49)	Heavy Vehicle 10³ Gals. (50–54)	Off Hiway 10³ Gals. (55–59)	DIESEL FUEL Heavy Vehicle 10³ Gals. (60–64)	Off Hiway 10⁴ Gals. (65–67)	Rail Locomotive 10⁴ Gals. (68–72)	County Population 10³ (73–76)	Density Code (77)	Action (78)	(79)	cd (80)
			6612								20	7		A	A	3

AIRCRAFT Military LTO CYC 10² (10–13)	Civil LTO CYC 10¹ (14–18)	Commercial LTO CYC 10¹ (19–23)	VESSELS Anth. Coal 10¹ tons (24–27)	Diesel Oil 10⁴ Gals. (28–31)	Resid. Oil 10⁴ Gals. (32–36)	Gasoline 10² Gals. (37–40)	EVAPORATION Solvent Purchased tons yr (41–46)	Gasoline Marketed 10⁴ Gals. (47–51)	MEASURED VEHICLE MILES Limited Access Road 10⁴ Miles (52–57)	Rural Roads 10⁴ Miles (58–63)	# GAS WELLS (64–69)	Urban Roads 10⁴ Miles (70–76)	(77)	Action (78)	(79)	cd (80)
							58	70		5603	1			A	A	4

CUTBACK ASPHALT 100 lbs (10–16)	NT GAS LEAKS 100 lbs (17–21)	DRY CLN SOLVENT 100 lbs (22–26)	PESTICIDE USE lbs (27–31)	FOREST FIRES Area - Acres (32–38)	Quant. ton/acre (39–41)	MISC + SLASH BURNING Area - Acres (42–47)	Quant. tons acre (48–50)	OIL SLUDGE bbls. (51–54)	(55–57)	Structure Fires #/year (58–61)	# OIL WELLS (62–67)	(68–70)	(71–77)	Action (78)	(79)	cd (80)
189	67	205	21700			500	3			26	1522			A	A	5

COMMENTS (10–77)	Action (78)	(79)	cd (80)
WASHINGTON COUNTY 1977	A	A	6

EPA DUR 219
3/72

State	County	AQCR
1 2	3 4 5 6	7 8 9
37	3140	186

AREA SOURCE
Input Form

Date ________

Name of Person Completing Form G. T. Vinzani

Year of Record	EMISSION ESTIMATES (10^2 tons) Particulate	SO_2	NO_x	HC	CO	SULFUR CONTENT (%) Anth. Coal	Bitum. Coal	Dist. Oil	Resid. Oil	ASH CONTENT (%) Anth. Coal	Bitum. Coal	RESIDENTIAL FUEL Anth. 10^1 tons	Bitumin. 10^1 tons	Dist. Oil 10^4 Gal.	Resid. Oil 10^4 Gal.	Nat. Gas 10^7 ft.^{3}	Wood 10^2 tons	Action		cd
10 11	12 13 14 15 16	17 18 19 20 21	22 23 24 25	26 27 28 29 30	31 32 33 34 35	36 37	38 39	40 41	42 43	44 45 46	47 48 49	50 51 52 53	54 55 56 57 58	59 60 61 62 63	64 65 66 67 68	69 70 71 72 73	74 75 76 77	78	79	80
82																184		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL Anth. 10^1 tons	Bitumin. 10^1 tons	Dist. Oil 10^4 Gals.	Resid. Oil 10^4 Gals.	Nat. Gas 10^7 Ft^3	Wood 10^2 tons	Anth. Coal 10^1 tons	Bitum. Coal 10^1 tons	OFF-HGWY GASOLINE Farm 10^3 gal	Constr. 10^3 gal	Sm. Engn. 10^3 gal.	INDUST FUEL Nat. Gas 10^7 ft^3	OFF HGWY DIESEL Farm 10^3 gal	Const. 10^4 gal		Action		cd
10 11 12 13 14	15 16 17 18 19	20 21 22 23 24	25 26 27 28 29	30 31 32 33	34 35	36 37 38 39 40 41	42 43 44 45 46 47	48 49 50 51	52 53 54 55 56	57 58 59 60 61	62 63 64 65 66	67 68 69	70 71 72 73	74 75 76 77	78	79	80
				137				133	25	32		116	25		A	A	2

ON SITE INCINERATION Residential 10^1 tons	Industrial 10^2 tons	Comm. Inst. 10^2 tons	OPEN BURNING Residential tons	Industrial 10^2 tons	Comm'l-Instit. 10^2 tons	GASOLINE FUEL Light Vehicle 10^3 Gals.	Heavy Vehicle 10^3 Gals.	Off Hiway 10^3 Gals.	DIESEL FUEL Heavy Vehicle 10^3 Gals.	Off Hiway 10^4 Gals.	Rail Locomotive 10^4 Gals.	County Population 10^3	Density Code	Action		cd
10 11 12 13 14 15	16 17 18 19 20	21 22 23 24	25 26 27 28 29 30	31 32 33 34 35 36	37 38 39 40 41 42	43 44 45 46 47 48 49	50 51 52 53 54	55 56 57 58 59	60 61 62 63 64	65 66 67	68 69 70 71 72	73 74 75 76	77	78	79	80
			6672								20	7		A	A	3

AIRCRAFT Military LTO CYC 10^2	Civil LTO CYC 10^1	Commercial LTO CYC 10^1	VESSELS Anth. Coal 10^1 tons	Diesel Oil 10^4 Gals.	Resid. Oil 10^4 Gals.	Gasoline 10^2 Gals.	EVAPORATION Solvent Purchased tons yr	Gasoline Marketed 10^4 Gals.	MEASURED VEHICLE MILES Limited Access Road 10^4 Miles	Rural Roads 10^4 Miles	# GAS WELLS	Urban Roads 10^4 Miles		Action		cd
10 11 12 13	14 15 16 17 18	19 20 21 22 23	24 25 26 27	28 29 30 31	32 33 34 35 36	37 38 39 40	41 42 43 44 45 46	47 48 49 50 51	52 53 54 55 56 57	58 59 60 61 62 63	64 65 66 67 68 69	70 71 72 73 74 75 76	77	78	79	80
							72	90		6331	1			A	A	4

CUTBACK ASPHALT 100 lbs	NT GAS LEAKS 100 lbs	DRY CLN SOLVENT 100 lbs	PESTICIDE USE lbs	FOREST FIRES Area - Acres	Quant. ton/acre	MISC + SLASH BURNING Area - Acres	Quant. tons acre	OIL SLUDGE bbls.	Structure Fires N/year	# OIL WELLS		Action		cd
10 11 12 13 14 15 16	17 18 19 20 21	22 23 24 25 26	27 28 29 30 31	32 33 34 35 36 37 38	39 40 41	42 43 44 45 46 47	48 49 50	51 52 53 54 55 56 57	58 59 60 61	62 63 64 65 66 67	68 69 70 71 72 73 74 75 76 77	78	79	80
214	54	207	26401			500	3		30	1522		A	A	5

COMMENTS	Action		cd
10–77	78	79	80
WASHINGTON COUNTY 1982	A	A	6

EPA DUR. 219
3/72

AREA SOURCE
Input Form
Date ________

Name of Person Completing Form G. T. Vinzani

State (1-2)	County (3-6)	AQCR (7-9)
37	3140	186

Year of Record (10-11)	EMISSION ESTIMATES (10^2 tons): Particulate (12-16)	SO_2 (17-21)	NO_x (22-25)	HC (26-30)	CO (31-35)	SULFUR CONTENT (%): Anth. Coal (36-37)	Bitum. Coal (38-39)	Dist. Oil (40-41)	Resid Oil (42-43)	ASH CONTENT (%): Anth. Coal (44-46)	Bitum. Coal (47-49)	RESIDENTIAL FUEL: Anth. 10^1 tons (50-53)	Bitumin. 10^1 tons (54-58)	Dist. Oil 10^4 Gal. (59-63)	Resid. Oil 10^4 Gal. (64-68)	Nat. Gas 10^7 ft.^{3} (69-73)	Wood 10^2 tons (74-77)	Action (78)	79	cd (80)
87																186		A	A	1

COMMERCIAL AND INSTITUTIONAL FUEL: Anth. 10^1 tons (10-14)	Bitumin. 10^1 tons (15-19)	Dist. Oil 10^4 Gals. (20-24)	Resid. Oil 10^4 Gals. (25-29)	Nat. Gas 10^7 Ft^3 (30-33)	Wood 10^2 tons (34-35)	Anth. Coal 10^1 tons (36-41)	Bitum. Coal 10^1 tons (42-47)	OFF-HGWY GASOLINE: Farm 10^3 gal (48-51)	Constr. 10^3 gal (52-56)	Sm. Engn. 10^3 gal. (57-61)	INDUST FUEL: Nat. Gas 10^7 ft^3 (62-66)	OFF HGWY DIESEL: Farm 10^3 gal (67-69)	Const. 10^4 gal (70-73)	(74-77)	Action (78)	79	cd (80)
				162				138	29	33		120	29		A	A	2

ON SITE INCINERATION: Residential 10^1 tons (10-15)	Industrial 10^2 tons (16-20)	Comm. Inst. 10^2 tons (21-24)	OPEN BURNING: Residential tons (25-30)	Industrial 10^2 tons (31-36)	Comm'l-Instit. 10^2 tons (37-42)	GASOLINE FUEL: Light Vehicle 10^3 Gals. (43-49)	Heavy Vehicle 10^3 Gals. (50-54)	Off Hiway 10^3 Gals. (55-59)	DIESEL FUEL: Heavy Vehicle 10^3 Gals. (60-64)	Off Hiway 10^4 Gals. (65-67)	Rail Locomotive 10^4 Gals. (68-72)	County Population 10^3 (73-76)	Density Cd # (77)	Action (78)	79	cd (80)
			6744								20	8		A	A	3

AIRCRAFT: Military LTO CYC 10^2 (10-13)	Civil LTO CYC 10^1 (14-18)	Commercial LTO CYC 10^1 (19-23)	VESSELS: Anth. Coal 10^1 tons (24-27)	Diesel Oil 10^4 Gals. (28-31)	Resid. Oil 10^4 Gals. (32-36)	Gasoline 10^2 Gals. (37-40)	EVAPORATION: Solvent Purchased tons yr (41-46)	Gasoline Marketed 10^4 Gals. (47-51)	MEASURED VEHICLE MILES: Limited Access Road 10^4 Miles (52-57)	Rural Roads 10^4 Miles (58-63)	# GAS WELLS (64-69)	Urban Roads 10^4 Miles (70-76)	(77)	Action (78)	79	cd (80)
							84	110		7172	1			A	A	4

CUTBACK ASPHALT 100 lbs (10-16)	NT GAS LEAKS 100 lbs (17-21)	DRY CLN SOLVENT 100 lbs (22-26)	PESTICIDE USE lbs (27-31)	FOREST FIRES: Area - Acres (32-38)	Quant. ton/acre (39-41)	MISC + SLASH BURNING: Area - Acres (42-47)	Quant. tons/acre (48-50)	OIL SLUDGE bbls. (51-54)	(55-57)	Structure Fires #/year (58-61)	# OIL WELLS (62-67)	(68-70)	(71-77)	Action (78)	79	cd (80)
242	34	209	32121			500	3			30	1598			A	A	5

COMMENTS (10-77)	Action (78)	79	cd (80)
WASHINGTON COUNTY 1987	A	A	6

EPA DUR. 219
3/72

APPENDIX B

VOC/NO$_x$ SPLIT FACTOR FILE

APPENDIX B

VOC/NO_x SPLIT FACTOR FILE

Appendix B is divided into two sections. The first shows the VOC and NO_x pollutant split factor file for area sources. The second section presents the same data for point sources.

Each section is listed in order according to Source Classification Code. The following sequence is followed for all lines:[1]

1. SCC code - eight digit; and
2. Pollutant Code - HC (VOC), or NX (oxides of nitrogen).

For VOC, the following sequence is then followed:

3. Non-reactives - the first number is the % by weight of total emissions category. The second number is the average molecular weight of this class.
4. Paraffins - %, avg. M.W.
5. Olefins - %, avg. M.W.
6. Aromatics - %, avg. M.W.
7. Carbonyls - %, avg. M.W.
8. Ethylene - %, avg. M.W.

For oxides of nitrogen, the sequence is:

3. Nitric Oxide - % as NO_2, on weight basis, avg. M.W.
4. Nitrogen Dioxide - %, avg. M.W.

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[1] Decimal points are indicated by carats in the first line. They are also in the same position for each line thereafter.

AREA SOURCE VOC/NO_x PROFILES

BASE YEAR

SIC SCC	POL	NON-REACTIVE		PARAFFIN		OLEFIN		AROMATIC		CARBONYL		ETHYLENE	
P999990100500	HC	962	161	38	538								
P999990200500	HC	962	161	38	538								
P999990300500	HC	962	161	38	538								
P999990401300	HC	46	562	12	792	27	685	4	1320	11	726		
P999990501100	HC	19	260	491	886	296	678					194	280
P999990600700	HC	215	226	278	912	169	549	187	985	34	30	117	280
P999990600800	HC	215	226	278	912	169	549	187	985	34	30	117	280
P999990600900	HC	219	226	282	912	171	549	189	985	20	300	119	280
P999990700700	HC	97	322	411	1569	38	421	191	1115	160	300	103	280
P999990700800	HC	89	322	396	1569	37	421	185	1115	194	300	99	280
P999990702400	HC	45	323	618	1965	140	396	140	1780	57	593		
P999990803100	HC	12	227	50	874	15	585	17	977	6	30		
P999990803200	HC	12	227	50	874	15	585	17	977	6	30		
P999990803300	HC	12	227	50	874	15	585	17	977	6	30		
P999990904430	HC	214	226	277	912	168	549	186	985	38	300	117	280
P999991000100	HC	119	464	881	640	0	0	0	0	0	0	0	0
P999991000200	HC	119	464	881	640	0	0	0	0	0	0	0	0
P999991000300	HC	962	161	38	538								
P999991000600	HC	52	542	948	838	0	0	0	0	0	0	0	0
P999991000700	HC	962	161	38	538								
P999991000800	HC	59	542	410	1382	0	0	0	0	0	0	0	0
P999991000900	HC	223	781	577	864	0	0	200	1023	0	0	0	0
P999991005100	HC	256	556	638	145	0	0	33	78	59	300	14	280
P999991005200	HC	48	781	677	888	51	678	224	1085	0	0	0	0
P999991106100	HC	111	999	575	724	125	578	109	996	20	30	59	280
P999991106200	HC	115	999	564	726	127	576	111	995	21	30	61	280
P999991106400	HC	148	999	469	752	142	556	132	991	28	30	81	280
P999991308100	HC	286	24	454	860	69	470	0	0	0	0	191	280
P999991308200	HC	19	24	492	886	295	668	0	0	0	0	194	280
P999991308400	HC	46	566	120	792	270	685	40	1320	11	726	0	0
P999990100500	NX	95		5									
P999990200500	NX	95		5									
P999990300500	NX	95		5									
P999990401300	NX	85		15									
P999990501100	NX	85		15									
P999990600700	NX	95		5									
P999990600800	NX	95		5									
P999990600900	NX	95		5									
P999990700700	NX	90		10									
P999990700800	NX	90		10									
P999990702400	NX	90		10									
P999990803100	NX	97		3									
P999990803200	NX	97		3									
P999990803300	NX	97		3									
P999990904430	NX	95		5									
P999991106100	NX	90		10									
P999991106200	NX	90		10									
P999991106400	NX	90		10									
P999991308100	NX	85		15									
P999991308200	NX	85		15									
P999991308400	NX	85		15									

AREA SOURCE VOC/NO$_x$ PROFILES

1982

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P999990100500     HC  962  161   38  538
P999990200500     HC  962  161   38  538
P999990300500     HC  962  161   38  538
P999990401300     HC  46   562  12   792  27   685    4 1320  11   726
P999990501100     HC   19  260  491  886  296  678                   194  280
P999990600700     HC  215  226  278  912  169  549  187  985   34   30  117  280
P999990600800     HC  215  226  278  912  169  549  187  985   34   30  117  280
P999990600900     HC  219  226  282  912  171  549  189  985   20  300  119  280
P999990700700     HC   97  322  411 1569   38  421  191 1115  160  300  103  280
P999990700800     HC   89  322  396 1569   37  421  185 1115  194  300   99  280
P999990702400     HC   45  323  618 1965  140  396  140 1780   57  593
P999990803100     HC  12   227  50   874  15   585  17   977   6    30
P999990803200     HC  12   227  50   874  15   585  17   977   6    30
P999990803300     HC  12   227  50   874  15   585  17   977   6    30
P999990904430     HC  214  226  277  912  168  549  186  985   38  300  117  280
P999991000100     HC  119  464  881  640   0    0    0    0    0    0    0    0
P999991000200     HC  119  464  881  640   0    0    0    0    0    0    0    0
P999991000300     HC  962  161   38  538
P999991000600     HC   52  542  948  838   0    0    0    0    0    0    0    0
P999991000700     HC  962  161   38  538
P999991000800     HC  59   542  410 1382   0    0    0    0    0    0    0    0
P999991000900     HC  223  781  577  864   0    0  200 1023    0    0    0    0
P999991005100     HC  256  556  638  145   0    0   33   78   59  300   14  280
P999991005200     HC   48  781  677  888   51  678  224 1085   0    0    0    0
P999991106100     HC  114  999  568  722  130  586   99  973   24   30   64  280
P999991106200     HC  120  999  552  725  133  583  102  996   25   30   67  280
P999991106400     HC  155  999  453  759  150  564  120  992   34   30   89  280
P999991308100     HC  286  24   454  860   69  470   0    0    0    0   191  280
P999991308200     HC   19  24   492  886  295  668   0    0    0    0   194  280
P999991308400     HC  46   566  120  792  270  685   40 1320  11   726   0    0
P999990100500     NX  95         5
P999990200500     NX  95         5
P999990300500     NX  95         5
P999990401300     NX  85        15
P999990501100     NX  85        15
P999990600700     NX  95         5
P999990600800     NX  95         5
P999990600900     NX  95         5
P999990700700     NX  90        10
P999990700800     NX  90        10
P999990702400     NX  90        10
P999990803100     NX  97         3
P999990803200     NX  97         3
P999990803300     NX  97         3
P999990904430     NX  95         5
P999991106100     NX  90        10
P999991106200     NX  90        10
P999991106400     NX  90        10
P999991308100     NX  85        15
P999991308200     NX  85        15
P999991308400     NX  85        15
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AREA SOURCE VOC/NO_x PROFILES

1987

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P999990100500     HC  962  161   38  538
P999990200500     HC  962  161   38  538
P999990300500     HC  962  161   38  538
P999990401300     HC  46   562  12   792  27   685    4 1320  11   726
P999990501100     HC   19  260  491  886  296  678                       194  280
P999990600700     HC  215  226  278  912  169  549  187  985   34  30   117  280
P999990600800     HC  215  226  278  912  169  549  187  985   34  30   117  280
P999990600900     HC  219  226  282  912  171  549  189  985   20  300  119  280
P999990700700     HC   97  322  411 1569   38  421  191 1115  160  300  103  280
P999990700800     HC   89  322  396 1569   37  421  185 1115  194  300   99  280
P999990702400     HC   45  323  618 1965  140  396  140 1780   57  593
P999990803100     HC  12   227  50   874  15   585  17   977   6   30
P999990803200     HC  12   227  50   874  15   585  17   977   6   30
P999990803300     HC  12   227  50   874  15   585  17   977   6   30
P999990904430     HC  214  226  277  912  168  549  186  985   38  300  117  280
P999991000100     HC  119  464  881  640   0    0    0    0    0    0    0    0
P999991000200     HC  119  464  881  640   0    0    0    0    0    0    0    0
P999991000300     HC  962  161   38  538
P999991000600     HC   52  542  948  838   0    0    0    0    0    0    0    0
P999991000700     HC  962  161   38  538
P999991000800     HC  59   542  410 1382   0    0    0    0    0    0    0    0
P999991000900     HC  223  781  577  864   0    0  200 1023   0    0    0    0
P999991005100     HC  256  556  638  145   0    0   33  78    59  300   14  280
P999991005200     HC   48  781  677  888   51  678  224 1085   0    0    0    0
P999991106100     HC  135  999  510  735  140  574  109  994   29  300   76  280
P999991106200     HC  140  999  495  739  144  572  112  994   30  300   80  280
P999991106400     HC  171  999  406  783  158  556  128  990   37  300   99  280
P999991308100     HC  286  24   454  860   69  470   0    0    0    0   191  280
P999991308200     HC   19  24   492  886  295  668   0    0    0    0   194  280
P999991308400     HC  46   566  120  792  270  685   40 1320  11   726   0    0
P999990100500     NX  95         5
P999990200500     NX  95         5
P999990300500     NX  95         5
P999990401300     NX  85        15
P999990501100     NX  85        15
P999990600700     NX  95         5
P999990600800     NX  95         5
P999990600900     NX  95         5
P999990700700     NX  90        10
P999990700800     NX  90        10
P999990702400     NX  90        10
P999990803100     NX  97         3
P999990803200     NX  97         3
P999990803300     NX  97         3
P999990904430     NX  95         5
P999991106100     NX  90        10
P999991106200     NX  90        10
P999991106400     NX  90        10
P999991308100     NX  85        15
P999991308200     NX  85        15
P999991308400     NX  85        15
```

POINT SOURCE VOC/NO_x PROFILES

	SCC	POL	NON-REACTIVE		PARAFFIN		OLEFIN		AROMATIC		CARBONYL		ETHYLENE	
P	10100299	HC	722	181	109	833	98	750	55	1250	16	833	0	
P	10100402	HC	11	16	19	636	0		0		70	372	0	
P	10100501	HC	0		51	728	0	00	0		49	300	0	
P	10100601	HC	60	181	30	629	0	722	2	921	8	30	0	
P	10100603	HC	60	181	30	629	0	722	2	921	8	30	0	
P	10200401	HC	11	16	19	636	0		0		70	372	0	
P	10200402	HC	11	16	19	636	0		0		70	372	0	
P	10200501	HC	0		513	728	0				487	300	0	
P	10200601	HC	600	181	30	629	0	0	20	921	80	300		
P	10200602	HC	60	181	30	629	0	00	2	921	8	300	0	
P	10200603	HC	60	181	30	629	0	0	2	921	8	300	0	
P	10200701	HC	284	261	46	515	18	421	0		76	300	0	
P	20100201	HC	70	160	0		0		0		300	300	0	
P	20200102	HC	266	30	00	00	447	492					287	28
P	20200201	HC	70	16	0		0		0		300	300	0	
P	20200202	HC	86	17	12	459	0				1	30	1	28
P	30101899	HC	0		0		0		0		0		100	28
P	30303004	HC	50	461	30	441	0		0		20	300	0	
P	30400102	HC	911	721	0	0	3	412	0		0	0	059	28
P	30400301	HC	911	721	0	0	3	412	0		0	0	59	28
P	30400303	HC	911	721	0	0	3	412	0		0		59	28
P	30400399	HC	911	721	0	0	3	412	0		0		59	28
P	30400601	HC	911	721	0	0	3	412	0		0		59	28
P	30400701	HC	911	721	0	0	3	412	0		0		59	28
P	30400805	HC	911	721	0	0	3	412	0		0		59	28
P	30500201	HC	60	181	30	629	0	0	2	921	8	30	0	
P	30501401	HC	60	181	30	629	0	0	2	921	8	30	0	
P	30600104	HC	592	781	297	629	0	0	20	921	91	30	0	
P	30600201	HC	36	16	13	862	0		0		51	30	0	
P	30600301	HC	36	16	13	862	0		0		51	30	0	
P	30600402	HC	5	16	74	999	15	806	60	1162	0	0	0	
P	30600501	HC	7	369	93	737	0	0	0		0		0	
P	30600502	HC	7	630	93	737								
P	30600602	HC	621	16	334	601	44	661	0		0	0	01	28
P	30600701	HC	0		100	722	0	0	0		0		0	
P	30600801	HC	345	174	647	629	01	421	7	962	0		0	
P	30600802	HC	41	301	908	441	51	421						
P	30600803	HC	5	197	907	857	0	0	43	959	0		0	
P	30600804	HC	189	20	711	581	10	421						
P	30600805	HC	41	301	908	441	51	421	00	00	00	00	00	00
P	30600806	HC	41	301	908	441	51	421	00	00	00	00	00	00
P	30600808	HC	41	301	908	441	51	421	00	00	00	00	00	00
P	30600999	HC	500	781	30	441	0	0	00		20	30	0	
P	30601101	HC	00	00	975	1098	25	300	00	00	00	00	00	00
P	30601301	HC	174	1335	81	559	0	0	16	987	0	0	0	
P	30699999	HC	5	781	938	820	11	561	46	965	00	00	00	00
P	39000605	HC	60	461	30	629	0	0	20	921	8	30	0	
P	39000699	HC	60	941	30	629	0	0	2	921	8	30	0	
P	40100202	HC	1000	1320	00	00	0	0	0		0	0	00	
P	40100203	HC	1000	1660	00	00	0	0	0		0	0	00	
P	40100205	HC	1000	1310	00	00	0	0	0		0	0	00	
P	40200101	HC	00	00	00	00	00	00	774	958	226	638	00	00
P	40200501	HC	0	0	629	00	0	0	0		1000	123	00	28
P	40200599	HC	31	704	739	106	0	0	72	994	193	739	0	28
P	40200899	HC	124	203	586	308	57	531	21	921	460	929	00	28
P	40200901	HC	159	166	511	111	0	0	8	987	25	693	00	28
P	40299999	HC	25	1186	431	109	00	00	123	921	421	531	00	00
P	40300101	HC	48	781	677	888	51	678	224	1085	00	00	00	00
P	40300102	HC	139	200	847	621	0	0	14	921	0		0	
P	40300103	HC	48	781	677	888	51	678	224	1085	00	00	00	00

```
P   40300104   HC  139  200   847  621    0    0   14  921   00  00  00  00
P   40300105   HC             1000 1652
P   40300106   HC  139  200   847  621    0    0   14  921   0       0
P   40300107   HC  139  200   847  621    0    0   14  921   0       0
P   40300151   HC  139  200   847  621    0    0   14  921   0       0
P   40300152   HC    0    0  1000 1652              0    0   0       0
P   40300201   HC   48  781   677  888   51  678  224 1085   00  00  00  00
P   40300202   HC   48  781   677  888   51  678  224 1085   00  00  00  00
P   40300203   HC  139  200   847  621    0    0   14  921   00  00  00  00
P   40300204   HC  139  200   847  621    0    0   14  921   00  00  00  00
P   40300205   HC    0    0  1000 1652    0    0    0    0   0       0
P   40300207   HC  139  200   847  621    0    0   14  921   0       0
P   40300208   HC  100  781     0         0         0        0       0
P   40399999   HC  139  200   847  621    0    0   14  921   0       0
P   40600104   HC    0    0  1000 1652              0    0   00  00  00  00
P   40600105   HC    0         942  674    0    0   58  964   0       0
P   40600126   HC   48  781   677  888   51  678  224 1085   00  00  00  00
P   40600130   HC   00    0  1000 1652    0    0
P   49099999   HC  139  200   847  621    0    0   14  921   0       0
P   10100299   NX   94   30     6   46
P   10100402   NX   98   30     2   46
P   10100601   NX   94   30     6   46
P   10100603   NX   95   30     5   46
P   10200401   NX   98   30     2   46
P   10200402   NX   98   30     2   46
P   10200601   NX  940  300    60  460
P   10200602   NX   94   30     6   46
P   10200603   NX   94   30     6   46
P   10200701   NX  940  300    60  460
P   10300603   NX  850  300   150  460
P   20100201   NX   94  300     6  460
P   20200101   NX  900  300   100  460
P   20200102   NX   98   30     2  460
P   20200201   NX   94   30     6   46
P   20200202   NX   94   30    60   46
P   30303004   NX   90   30    10   46
P   30400301   NX   90          10
P   30400701   NX   90   30    10   46
P   30500304   NX   94   30     6   46
P   30500604   NX   94   30     6   46
P   30501401   NX   98   30     2   46
P   30502599   NX  940  300    60  460
P   30600104   NX   85   30    15   46
P   30600201   NX   87   30    13   46
P   30600301   NX   87   30    13   46
P   30600806   NX   85   30    15   46
P   30600808   NX   85   30    15   46
P   30600999   NX   85   30    15   46
P   30601101   NX   85   30    15   46
P   39000605   NX  850  300   150  460
P   39000606   NX  850  300   150  460
P   39000609   NX  850  300   150  460
P   39000699   NX   98   30     2   46
```

APPENDIX C

TEMPORAL DATA

For both point and area sources, temporal data were divided into three sections. The first section expresses the typical weekday as a percent of the oxidant season. (If no variations between weekday and weekend day occurred, 1.087% was used, since there were 92 days in the 1977 oxidant season). This section is characterized by a "D" in the final column. Typical hour of the day splits, characterized by an "H" in the last column, follow. Each hour of the day is expressed as a percentage of the whole typical weekday during the oxidant season. The 24 hours of the day are split into four six-hour groups identified in card column 79. The first group (1H) represents hours 01 through 06, and so on, with the fourth group (4H) providing data for hours 19 through 24. Finally, the seasonal distribution is given. It is characterized by the final "S". This section divides the year into the four seasons, beginning with December/January/February, and expresses each season as a percent of the entire year.

Decimal points have been added. They are in the same columns regardless of line number. The area source file is presented first, followed by the point source data. The file for area sources is organized by SCC while that for point sources is arranged according to state, county, plant, and point identification number taken from the EIS/P&R master file.

AREA SOURCE TEMPORAL FACTOR FILE

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					FACTOR			
	SCC	1	2	3	4	5	6	
P	90100500	1087						D
P	90200500	1370						D
P	90300500	1282						D
P	90401300	1385						D
P	90501100	1087						D
P	90600700	1282						D
P	90600800	1282						D
P	90600900	0362						D
P	90700700	1282						D
P	90700800	1282						D
P	90702400	1282						D
P	90803100	1136						D
P	90803200	0362						D
P	90803300	1111						D
P	90904430	0870						D
P	91000100	1087						D
P	91000200	1087						D
P	91000300	1087						D
P	91000600	1613						D
P	91000700	1087						D
P	91000800	1613						D
P	91000900	1087						D
P	91005100	1333						D
P	91005200	1087						D
P	91106100	1136						D
P	91106200	1006						D
P	91106400	1087						D
P	91308100	1087						D
P	91308200	1087						D
P	91308400	1087						D
P	90100500	35	33	33	32	33	29	1H
P	90100500	38	45	48	47	50	51	2H
P	90100500	49	49	47	45	45	46	3H
P	90100500	45	44	43	40	38	35	4H
P	90200500	55	6	6	6	6	6	1H
P	90200500	5	4	3	3	25	2	2H
P	90200500	2	2	2	25	3	35	3H
P	90200500	4	45	5	55	55	55	4H
P	90300500	35	4	45	5	55	55	1H
P	90300500	55	55	6	6	6	6	2H
P	90300500	6	5	4	3	3	25	3H
P	90300500	2	2	2	2	25	3	4H
P	90401300	0	0	0	0	0	1	1H
P	90401300	1	10	10	10	10	10	2H
P	90401300	10	10	10	10	7	1	3H
P	90401300	0	0	0	0	0	0	4H
P	90501100	0	0	0	0	0	1	1H
P	90501100	7	7	7	7	7	7	2H
P	90501100	7	7	7	7	7	7	3H
P	90501100	7	7	1	0	0	0	4H
P	90600700	0	0	0	0	0	1	1H
P	90600700	7	7	7	7	7	7	2H
P	90600700	7	7	7	7	7	7	3H
P	90600700	7	7	1	0	0	0	4H
P	90600800	0	0	0	0	0	1	1H
P	90600800	7	7	7	7	7	7	2H
P	90600800	7	7	7	7	7	7	3H
P	90600800	7	7	1	0	0	0	4H
P	90600900	0	0	0	0	0	1	1H
P	90600900	7	7	7	7	7	7	2H

```
P     90600900     7     7     7     7     7     7          3H
P     90600900     7     7     1     0     0     0          4H
P     90700700     0     0     0     0     0     1          1H
P     90700700     7     7     7     7     7     7          2H
P     90700700     7     7     7     7     7     7          3H
P     90700700     7     7     1     0     0     0          4H
P     90700800     0     0     0     0     0     1          1H
P     90700800     7     7     7     7     7     7          2H
P     90700800     7     7     7     7     7     7          3H
P     90700800     7     7     1     0     0     0          4H
P     90702400     3     3     3     4     4     4          1H
P     90702400     5     5     5     5     5     5          2H
P     90702400     5     5     5     5     5     5          3H
P     90702400     4     3     3     3     3     3          4H
P     90803100     3     3     3     4     4     4          1H
P     90803100     5     5     5     5     5     5          2H
P     90803100     5     5     5     5     5     5          3H
P     90803100     4     3     3     3     3     3          4H
P     90803200     2     2     2     2     3     3          1H
P     90803200     4     5     6     6     6     6          2H
P     90803200     5     6     6     6     6     4          3H
P     90803200     4     4     4     3     3     2          4H
P     90803300     3     3     3     4     4     4          1H
P     90803300     5     5     5     5     5     5          2H
P     90803300     5     5     5     5     5     5          3H
P     90803300     4     3     3     3     3     3          4H
P     90904430     1     1     1     1     1     2          1H
P     90904430     6     6     6     6     6     6          2H
P     90904430     6     6     6     6     6     6          3H
P     90904430     6     6     3     2     2     2          4H
P     91000100     4     4     4     4     4     4          1H
P     91000100     4     4     4     4     4     5          2H
P     91000100     5     5     5     4     4     4          3H
P     91000100     4     4     4     4     4     4          4H
P     91000200     3     3     3     3     4     4          1H
P     91000200     4     5     5     5     5     5          2H
P     91000200     5     5     5     5     4     4          3H
P     91000200     4     4     4     4     4     3          4H
P     91000300     3     3     3     3     4     4          1H
P     91000300     4     5     5     5     4     5          2H
P     91000300     5     5     5     5     5     4          3H
P     91000300     4     4     4     4     4     3          4H
P     91000600     0     0     0     0     0     0          1H
P     91000600     0    12    12    12    12     4          2H
P     91000600    12    12    12    12     0     0          3H
P     91000600     0     0     0     0     0     0          4H
P     91000700     4     4     4     4     4     4          1H
P     91000700     4     4     4     5     5     5          2H
P     91000700     5     4     4     4     4     4          3H
P     91000700     4     4     4     4     4     4          4H
P     91000800     0     0     0     0     0    10          1H
P     91000800    12    12    12    12    12    10          2H
P     91000800     5     5     5     5     0     0          3H
P     91000800     0     0     0     0     0     0          4H
P     91000900     4     4     4     4     4     4          1H
P     91000900     4     4     4     5     5     5          2H
P     91000900     5     4     4     4     4     4          3H
P     91000900     4     4     4     4     4     4          4H
P     91005100     0     0     0     0     0     0          1H
P     91005100     5    10    10    10    10    10          2H
```

```
P   91005100    10    10    10    10    5    0          3H
P   91005100     0     0     0     0    0    0          4H
P   91005200    26    21    19    05   01   01          1H
P   91005200    05    29    70    62   40   40          2H
P   91005200    46    46    46    46   76   85          3H
P   91005200    87    66    66    49   40   28          4H
P   91106100    17    13    10    10   14   23          1H
P   91106100    39    25    30    38   50   59          2H
P   91106100    61    59    64    78   71   72          3H
P   91106100    68    58    49    38   30   24          4H
P   91106200    06    05    05    06   12   27          1H
P   91106200    41    47    59    65   65   62          2H
P   91106200    67    71    78    80   74   62          3H
P   91106200    50    35    29    24   18   12          4H
P   91106400    12    07    05    07   15   28          1H
P   91106400    48    44    54    56   56   59          2H
P   91106400    60    66    69    81   80   66          3H
P   91106400    48    39    34    29   22   15          4H
P   91308100     4     4     4     4    4    4          1H
P   91308100     4     4     4     5    5    5          2H
P   91308100     5     4     4     4    4    4          3H
P   91308100     4     4     4     4    4    4          4H
P   91308200     0     0     0     0    0    1          1H
P   91308200     7     7     7     7    7    7          2H
P   91308200     7     7     7     7    7    7          3H
P   91308200     7     7     1     0    0    0          4H
P   91308400     5     5     4     4    4    4          1H
P   91308400     4     4     4     4    4    4          2H
P   91308400     4     4     4     4    4    4          3H
P   91308400     4     4     4     4    5    5          4H
P   90100500   645   145    65   145                    S
P   90200500   401   226   147   226                    S
P   90300500    23    23    27    27                    S
P   90401300    25    25    25    25                    S
P   90501100    25    25    25    25                    S
P   90600700    18    36    18    28                    S
P   90600800    10    30    30    30                    S
P   90600900    10    30    40    20                    S
P   90700700    18    36    18    28                    S
P   90700800    10    30    30    30                    S
P   90702400    25    25    25    25                    S
P   90803100    25    25    25    25                    S
P   90803200    25    25    25    25                    S
P   90803300    25    25    25    25                    S
P   90904430    15    30    30    25                    S
P   91000100    15    25    35    25                    S
P   91000200    24    26   251   249                    S
P   91000300    25    25    25    25                    S
P   91000600    15    30    30    25                    S
P   91000700    25    25    25    25                    S
P   91000800    25    25    25    25                    S
P   91000900     0    30    60    10                    S
P   91005100    23    27    26    24                    S
P   91005200    20    25    30    25                    S
P   91106100   264   186   257   293                    S
P   91106200   246   208   251   295                    S
P   91106400   248   234   267   261                    S
P   91308100    25    25    25    25                    S
P   91308200    25    25    25    25   25               S
P   91308400    25    25    25    25                    S
```

POINT SOURCE TEMPORAL FACTOR FILE

ST CTY PLTPT	FACTOR 1 2 3 4 5 6	
K370760000901	10870	D
K370760000902	10870	D
K370760000903	10870	D
K370760000904	10870	D
K372240000124	10870	D
K372240000141	10870	D
K372240000142	10870	D
K372240000601	10870	D
K372240000602	10870	D
K372240000603	10870	D
K372260000501	10870	D
K372620000101	10870	D
K372620000102	12210	D
K372620000103	10870	D
K372620000104	10870	D
K372620000207	10870	D
K372620000208	10870	D
K373020000839	10870	D
K373020000901	30038	D
K373020000902	14338	D
K373020000903	17543	D
K373020000904	28992	D
K373020001002	15384	D
K373020001003	15384	D
K373020001004	15384	D
K373020001005	15384	D
K373020001006	15384	D
K373020001801	10870	D
K373020001802	10870	D
K373020001803	10870	D
K373020001804	10870	D
K373020001805	10870	D
K373020001806	10870	D
K373020001807	10870	D
K373020001808	10870	D
K373020001809	10870	D
K373020001810	10870	D
K373020001811	10870	D
K373020001812	10870	D
K373020001813	10870	D
K373020001814	10870	D
K373020001815	10870	D
K373020001816	10870	D
K373020001817	10870	D
K373020001818	10870	D
K373020001819	10870	D
K373020001820	10870	D
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K373020001828     41667  41667  41667  41667  41667  41667                        2H
K373020001828     41667  41667  41667  41667  41667  41667                        3H
```

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K373020001828          41667  41667  41667  41667  41667  41667                          4H
K373020001829          41667  41667  41667  41667  41667  41667                          1H
K373020001829          41667  41667  41667  41667  41667  41667                          2H
K373020001829          41667  41667  41667  41667  41667  41667                          3H
K373020001829          41667  41667  41667  41667  41667  41667                          4H
K373020001830          41667  41667  41667  41667  41667  41667                          1H
K373020001830          41667  41667  41667  41667  41667  41667                          2H
K373020001830          41667  41667  41667  41667  41667  41667                          3H
K373020001830          41667  41667  41667  41667  41667  41667                          4H
K373020001831          41667  41667  41667  41667  41667  41667                          1H
K373020001831          41667  41667  41667  41667  41667  41667                          2H
K373020001831          41667  41667  41667  41667  41667  41667                          3H
K373020001831          41667  41667  41667  41667  41667  41667                          4H
K373020002201          41667  41667  41667  41667  41667  41667                          1H
K373020002201          41667  41667  41667  41667  41667  41667                          2H
K373020002201          41667  41667  41667  41667  41667  41667                          3H
K373020002201          41667  41667  41667  41667  41667  41667                          4H
K373020002202          41667  41667  41667  41667  41667  41667                          1H
K373020002202          41667  41667  41667  41667  41667  41667                          2H
K373020002202          41667  41667  41667  41667  41667  41667                          3H
K373020002202          41667  41667  41667  41667  41667  41667                          4H
K373020002203          41667  41667  41667  41667  41667  41667                          1H
K373020002203          41667  41667  41667  41667  41667  41667                          2H
K373020002203          41667  41667  41667  41667  41667  41667                          3H
K373020002203          41667  41667  41667  41667  41667  41667                          4H
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K373020002205          41667  41667  41667  41667  41667  41667                          3H
K373020002205          41667  41667  41667  41667  41667  41667                          4H
K373020002206          41667  41667  41667  41667  41667  41667                          1H
K373020002206          41667  41667  41667  41667  41667  41667                          2H
K373020002206          41667  41667  41667  41667  41667  41667                          3H
K373020002206          41667  41667  41667  41667  41667  41667                          4H
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K373020002207          41667  41667  41667  41667  41667  41667                          4H
K373020002208          41667  41667  41667  41667  41667  41667                          1H
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K373020002209          41667  41667  41667  41667  41667  41667                          1H
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K373020002209          41667  41667  41667  41667  41667  41667                          3H
K373020002209          41667  41667  41667  41667  41667  41667                          4H
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K373020002211          41667  41667  41667  41667  41667  41667                          3H
K373020002211          41667  41667  41667  41667  41667  41667                          4H
K373020002212          41667  41667  41667  41667  41667  41667                          1H
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K373020002212          41667  41667  41667  41667  41667  41667                          3H
K373020002212          41667  41667  41667  41667  41667  41667                          4H
K373020002214          41667  41667  41667  41667  41667  41667                          1H
K373020002214          41667  41667  41667  41667  41667  41667                          2H
K373020002214          41667  41667  41667  41667  41667  41667                          3H
```

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K373020002214       41667  41667  41667  41667  41667  41667            4H
K373020002215       41667  41667  41667  41667  41667  41667            1H
K373020002215       41667  41667  41667  41667  41667  41667            2H
K373020002215       41667  41667  41667  41667  41667  41667            3H
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K373020002216       41667  41667  41667  41667  41667  41667            2H
K373020002216       41667  41667  41667  41667  41667  41667            3H
K373020002216       41667  41667  41667  41667  41667  41667            4H
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K373020002217       41667  41667  41667  41667  41667  41667            2H
K373020002217       41667  41667  41667  41667  41667  41667            3H
K373020002217       41667  41667  41667  41667  41667  41667            4H
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K373020002218       41667  41667  41667  41667  41667  41667            2H
K373020002218       41667  41667  41667  41667  41667  41667            3H
K373020002218       41667  41667  41667  41667  41667  41667            4H
K373020002219       41667  41667  41667  41667  41667  41667            1H
K373020002219       41667  41667  41667  41667  41667  41667            2H
K373020002219       41667  41667  41667  41667  41667  41667            3H
K373020002219       41667  41667  41667  41667  41667  41667            4H
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K373020002222       41667  41667  41667  41667  41667  41667            4H
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K373020002223       41667  41667  41667  41667  41667  41667            2H
K373020002223       41667  41667  41667  41667  41667  41667            3H
K373020002223       41667  41667  41667  41667  41667  41667            4H
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K373020002224       41667  41667  41667  41667  41667  41667            3H
K373020002224       41667  41667  41667  41667  41667  41667            4H
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K373020002225       41667  41667  41667  41667  41667  41667            2H
K373020002225       41667  41667  41667  41667  41667  41667            3H
K373020002225       41667  41667  41667  41667  41667  41667            4H
K373020002226       41667  41667  41667  41667  41667  41667            1H
K373020002226       41667  41667  41667  41667  41667  41667            2H
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K373020002226       41667  41667  41667  41667  41667  41667            4H
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K373020002228       41667  41667  41667  41667  41667  41667            2H
K373020002228       41667  41667  41667  41667  41667  41667            3H
K373020002228       41667  41667  41667  41667  41667  41667            4H
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K373020002233       41667  41667  41667  41667  41667  41667            2H
K373020002233       41667  41667  41667  41667  41667  41667            3H
K373020002233       41667  41667  41667  41667  41667  41667            4H
K373020002234       41667  41667  41667  41667  41667  41667            1H
K373020002234       41667  41667  41667  41667  41667  41667            2H
K373020002234       41667  41667  41667  41667  41667  41667            3H
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K373020002234      41667  41667  41667  41667  41667  41667                  4H
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K373020002235      41667  41667  41667  41667  41667  41667                  2H
K373020002235      41667  41667  41667  41667  41667  41667                  3H
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K373020002241      41667  41667  41667  41667  41667  41667                  2H
K373020002241      41667  41667  41667  41667  41667  41667                  3H
K373020002241      41667  41667  41667  41667  41667  41667                  4H
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K373020002243      41667  41667  41667  41667  41667  41667                  4H
K373020002245      41667  41667  41667  41667  41667  41667                  1H
K373020002245      41667  41667  41667  41667  41667  41667                  2H
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K373020002246      41667  41667  41667  41667  41667  41667                  2H
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K373020002247      41667  41667  41667  41667  41667  41667                  3H
K373020002247      41667  41667  41667  41667  41667  41667                  4H
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K373020002249      41667  41667  41667  41667  41667  41667                  2H
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K373020002251      41667  41667  41667  41667  41667  41667                  4H
K373020002252      41667  41667  41667  41667  41667  41667                  1H
K373020002252      41667  41667  41667  41667  41667  41667                  2H
K373020002252      41667  41667  41667  41667  41667  41667                  3H
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November 16, 1978

Item No. 1 Area Source Emissions

The area source emissions from natural gas usage for residential and commercial are calculated for August and September.

The number of commercial and residential units were obtained from an environmental survey. The survey was done by our office.

Natural gas usage was obtained from Oklahoma Natural Gas Company for the year and for August and September.

Emissions were calculated using emission factors from AP-42.

A computer printout is available listing emissions by square mile.

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K373020002252          41667  41667  41667  41667  41667  41667                       4H
K373020002253          41667  41667  41667  41667  41667  41667                       1H
K373020002253          41667  41667  41667  41667  41667  41667                       2H
K373020002253          41667  41667  41667  41667  41667  41667                       3H
K373020002253          41667  41667  41667  41667  41667  41667                       4H
K373020002254          41667  41667  41667  41667  41667  41667                       1H
K373020002254          41667  41667  41667  41667  41667  41667                       2H
K373020002254          41667  41667  41667  41667  41667  41667                       3H
K373020002254          41667  41667  41667  41667  41667  41667                       4H
K373020002256          41667  41667  41667  41667  41667  41667                       1H
K373020002256          41667  41667  41667  41667  41667  41667                       2H
K373020002256          41667  41667  41667  41667  41667  41667                       3H
K373020002256          41667  41667  41667  41667  41667  41667                       4H
K373020002258          41667  41667  41667  41667  41667  41667                       1H
K373020002258          41667  41667  41667  41667  41667  41667                       2H
K373020002258          41667  41667  41667  41667  41667  41667                       3H
K373020002258          41667  41667  41667  41667  41667  41667                       4H
K373020002259          41667  41667  41667  41667  41667  41667                       1H
K373020002259          41667  41667  41667  41667  41667  41667                       2H
K373020002259          41667  41667  41667  41667  41667  41667                       3H
K373020002259          41667  41667  41667  41667  41667  41667                       4H
K373020002260          41667  41667  41667  41667  41667  41667                       1H
K373020002260          41667  41667  41667  41667  41667  41667                       2H
K373020002260          41667  41667  41667  41667  41667  41667                       3H
K373020002260          41667  41667  41667  41667  41667  41667                       4H
K373020002261          41667  41667  41667  41667  41667  41667                       1H
K373020002261          41667  41667  41667  41667  41667  41667                       2H
K373020002261          41667  41667  41667  41667  41667  41667                       3H
K373020002261          41667  41667  41667  41667  41667  41667                       4H
K373020002262          41667  41667  41667  41667  41667  41667                       1H
K373020002262          41667  41667  41667  41667  41667  41667                       2H
K373020002262          41667  41667  41667  41667  41667  41667                       3H
K373020002262          41667  41667  41667  41667  41667  41667                       4H
K373020002301          41667  41667  41667  41667  41667  41667                       1H
K373020002301          41667  41667  41667  41667  41667  41667                       2H
K373020002301          41667  41667  41667  41667  41667  41667                       3H
K373020002301          41667  41667  41667  41667  41667  41667                       4H
K373020002302          41667  41667  41667  41667  41667  41667                       1H
K373020002302          41667  41667  41667  41667  41667  41667                       2H
K373020002302          41667  41667  41667  41667  41667  41667                       3H
K373020002302          41667  41667  41667  41667  41667  41667                       4H
K373020002303          41667  41667  41667  41667  41667  41667                       1H
K373020002303          41667  41667  41667  41667  41667  41667                       2H
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K373020002305          41667  41667  41667  41667  41667  41667                       3H
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K373020002307          41667  41667  41667  41667  41667  41667                       1H
K373020002307          41667  41667  41667  41667  41667  41667                       2H
K373020002307          41667  41667  41667  41667  41667  41667                       3H
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K373020002308          41667  41667  41667  41667  41667  41667                2H
K373020002308          41667  41667  41667  41667  41667  41667                3H
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K373020002312          41667  41667  41667  41667  41667  41667                4H
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APPENDIX D

TULSA CITY-COUNTY HEALTH DEPARTMENT

AREA SOURCE REPORT

AREA SOURCE EMISSIONS INVENTORY FOR TULSA, OKLAHOMA

VOLUME II

SPECIFIC AREA SOURCE EMISSION INVENTORY

Tulsa City-County Health Department
Air Quality Section
4616 East 15th Street
Tulsa, Oklahoma 74112

EPA Order No. DA-8-6551J

Prepared for
ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Research Triangle Park, N.C. 27711

April, 1979

OKLAHOMA NATURAL GAS COMPANY
Post Office Box [illegible]
TULSA, OKLAHOMA [illegible]
(918) 583-6161

" AQMA "

Mcf Delivered

	12 mos. ended August, 1977	August, 1977	September, 1977
Residential	17,256,122	373,683	403,683
Commercial	10,044,395	491,089	444,256
Industrial	59,278,110	5,780,567	5,993,218
City Gate	577,877	14,179	13,846
TOTAL	87,156,504	6,659,518	6,855,003

Average annual use per residential customer - 122.4 Mcf

" " " Commercial " -229.3 Mcf

Glen Castleberry
November 9, 1978

Item No. 2 Special Inventory and Inspections with Engineering-Science

Our office received special inventory forms from Engineering-Science and reviewed these forms and suggested changes. The final forms were mailed to various industries with the states annual emission inventory forms.

We sent the completed forms, including copies of annual emission inventory forms to Engineering-Science.

After reviewing the completed forms, Engineering-Science requested more information. John Wickersham and myself set up appointments for office conferences with Public Service Co. (Tulsa and Jenks), Williams Brothers, Explorer Pipeline, and Sun Oil Company. Mr. Toothman and Mr. Vanzani were introduced to the representatives of the industries and were able to obtain some helpful information.

The inventory forms and subsequent information has all been forwarded to Engineering-Science.

Item No. 3 Oil and Gas Production Data

The State of Oklahoma Corporation Commission was contacted for information on oil and gas production.

The Corporation Commission supplied a document of secondary recovery compiled by their Oil and Gas Conservation Department. The document was 1976 statistical information (the latest available).

The Corporation Commission supplied 1977 data for oil and gas production in Tulsa County.

The following pages list the data received and the emissions calculated from the data.

The emissions were calculated using the latest emission factors. These factors were developed by Radian Company in Austin, Texas.

Item No. 3

1977 EMISSIONS INVENTORY - OIL & GAS PRODUCTION

Tulsa County

1. Data for overall production is 1977 figures. However detailed emissions for secondary recovery is based on 1976 data.

2. Oil Production - 1977 - Tulsa County.

   Wells: 1365 to 1379

   crude prod. 835,000 barrels ann.

   condensate 16,000 barrels ann.

3. Gas Production - 1977 - Tulsa County.

   5-8 wells

   Nat. Gas 176.94×10^6 ft^3/yr.

4. 1976 Secondary Recovery.

   38 projects

   144 injection wells

   28.277×10^6 fluids injected

   344 producing wells

   710,988 barrels produced.

5. 1977 wells/production less 76 secondary reduction.

Wells	Prod.
1379	835,000
-344	-710,988
1035 wells	124,012 barrels

6. Secondary production by type.

Type Injection	Injection		Production	
	Wells	Bbls.	Wells	Bbls.
Brackish	2	46,000	9	15,439
Gas			13	13,184
Fresh Water	17	78,000	48	31,267
Not Indicated	2	304,000	9	17,772

	Injection		Production	
6. continued	Wells	Bbls.	Wells	Bbls.
Strem Water	47	724,000	67	13,442
*Salt Water	76	27,125,000	198	619,904

*Remainder of total sec. prod & injection wells.

7. Emissions

A. Brine flooding

$520 \; \frac{\text{lbs}}{10^3 \text{ bbls}}$ (non methane)

(619,904 + 15439) = 635,343 = 635 (10^3) bbls.

635 x 520 = 330,200 lbs = 165.1 tons/yr.

B. H_2O Flood

$700 \; \frac{\text{lbs}}{10^3 \text{ bbls.}}$

700 x $(31.267 + 13.442)10^3$ = 700 x 44.7 =

31,296 ÷ 2000 = 15.6 tons/yr.

C. 5% oil - water

124 lb/10^3 bbls non-methane

Using not indicated prod.

124 x 17.77 (10^3) = 2203 lb = 1.1 $\frac{\text{tons}}{\text{yr.}}$

D. Standard Prod emissions

40 lb/10^3 bbls crude

Using conv prod + gas inject SR = $(124 + 13.1)10^3$

137.1 x 40 = 2.7 tons/yr.

E. Natural Gas Production

175 lb/10^6 ft.^{3}

176.94 x 175 = 15.5 tons/yr.

F. Total Emissions

Conventional prod.	2.7
S.R. Total	181.8
165.1 + 15.6 + 1.1 = Total emissions oil prod.	184.5
Emissions gas prod.	15.5

Grand Total Emissions

Oil and Gas Prod - 200 tons

Grady Barrens
June 21, 1978

Item No. 5 Vessel Usage

I contacted the Lake Patrol Division of the Oklahoma Highway Patrol and the U. S. Corps of Engineers about vessel figures on Keystone Lake during 1977. Neither agency was able to give me more than general information.

However, the Reservoir Recreation Division of the Corps of Engineers stated that there were 15 to 25 boat ramps on Keystone. It was also stated that during the peak boating season as many as 200 boats per week day and as many as 1,000 boats per weekend day used the lake.

Item No. 6 Gasoline Marketing Update

The information for updating gasoline marketing was obtained from the Oklahoma Oil Marketers Association and a Tulsa City-County Health Department service station survey.

The total gasoline sales were obtained from the Oklahoma Oil Marketers Association. The August and September gasoline sales were obtained from the sales terminals.

The survey indicated 15.5 percent of the tanks at service stations do not have submerged fill (drop tubes), therefore increasing the emissions.

The following is the total emissions and the prorated emissions for August and September. The computer printout is a list of total emissions per square mile. Emissions by square mile were obtained by comparing total emissions for 1974 with total emissions for 1977. The compared totals show an increase of 19.77 percent. Each square mile was adjusted to reflect this increase.

Item No. 6 Gasoline Marketing Update

V.O.C. losses from service stations in Tulsa.

Based on Table 4.4-4 of AP-42 Supplement 7 the following emission factors were combined to give a total hydrocarbon loss of 18.0 lbs/10^3 gal. transferred for submerged fill.

Submerged filling	7.3 lbs/10^3 gal. throughput
Underground tank breathing	1 lbs/10^3 gal. throughput
Displacement at vehicle	9 lbs/10^3 gal. throughput
Spillage	0.7 lbs/10^3 gal. throughput
	18.0 lbs/10^3 gal. throughput

For those outlets (service stations) that do not have submerged fill, the hydrocarbon losses are *4.4 lbs. per 10^3 gallons transferred more or 22.4 lbs. per 10^3 gallons throughput.

*Ref: Table 4.4-4 of AP-42.

The Tulsa City-County Health Department has determined from the most up to date survey of service stations that 15.5% of the tanks do not have submerged fill (drop tubes) or the drop tubes are over 1 foot short of complying with Regulation 15.

Using a total gasoline sales of 309 x 10^6 gallons per year based on an estimate by the Oklahoma Oil Marketers Association one can calculate the V.O.C. losses in the following manner:

A. Stations in compliance

$$\frac{309 \times 10^6 \text{ gallons}}{\text{yr.}} \times \frac{18 \text{ lbs.}}{10^3 \text{ gal.}} \times .845 \times \frac{1}{2000} = 2349.9$$

B. Stations not in compliance

$$\frac{309 \times 10^6 \text{ gallons}}{\text{yr.}} \times \frac{22.4 \text{ lbs.}}{10^3 \text{ gal.}} \times .155 \times \frac{1}{2000} = 536.4$$

Total loss = 2886.3 tons per year.

C. Prorate total for Aug. and Sept.

$$\frac{34.7 \times 10^6 \text{ gal/Aug. \& Sept.}}{309 \times 10^6 \text{ gal/yr.}} = 11\% \text{ of total}$$

2886.3 T/yr. x .11 = 317.5 T/Aug-Sept.

SERVICE STATION INVENTORY 11/16/78

SQUARE MILE	STORAGE 1000 GALLONS	EMISSIONS 1000 LBS/YR
102	21.56	12.91
182	47.91	28.68
183	28.74	17.21
192	94.62	56.65
193	52.70	31.55
194	47.91	28.68
202	19.16	11.47
273	16.77	10.04
284	22.76	13.63
291	173.67	103.99
292	100.61	60.24
293	119.77	71.71
294	16.77	10.04
383	43.12	25.82
392	92.22	55.22
393	149.71	89.64
483	19.16	11.47
492	92.22	55.22
493	73.06	43.74
583	40.72	24.38
592	19.16	11.47
593	75.46	45.18
594	68.27	40.87
683	38.33	22.95
692	68.27	40.87
693	231.16	138.40
694	100.61	60.24
703	8.38	5.02
790	14.37	8.61
793	100.61	60.24
794	103.00	61.67
892	14.37	8.61
893	130.55	78.16
894	160.49	96.10
993	74.26	44.46
994	119.77	71.71
1084	21.56	12.91
1091	19.16	11.47
1093	132.94	79.60
1174	23.95	14.34
1183	52.70	31.55
1184	195.23	116.89
1192	52.70	31.55
1193	43.12	25.82
1202	99.41	59.52
1203	16.77	10.04
1273	16.77	10.04
1283	57.49	34.42
1284	4.79	2.87
1292	40.72	24.38

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SERVICE STATION INVENTORY 11/16/78

SQUARE MILE	STORAGE 1000 GALLONS	EMISSIONS 1000 LBS/YR
1293	124.56	74.58
1302	126.96	76.01
1312	35.93	21.51
1393	119.77	71.71
1402	14.37	8.61
1403	1.20	.72
1492	23.95	14.34
1493	81.44	48.76
1593	94.62	56.65
1683	28.74	17.21
1693	100.61	60.24
1792	16.77	10.04
1793	82.64	49.48
1794	105.40	63.10
1803	38.33	22.95
1804	16.77	10.04
1824	17.97	10.76
1893	58.69	35.14
1894	95.82	57.37
1903	43.12	25.82
1924	14.37	8.61
1983	45.51	27.25
1993	23.95	14.34
1994	71.86	43.02
2003	35.93	21.51
2092	17.97	10.76
2094	31.14	18.64
2193	239.54	143.42
2203	35.93	21.51
2292	397.64	238.07
2293	150.91	90.35
2302	14.37	8.61
2322	71.86	43.02
2392	8.38	5.02
2393	191.63	114.73
2402	25.15	15.06
2413	68.27	40.87
2482	21.56	12.91
2483	2.40	1.43
2492	111.39	66.69
2493	182.05	109.00
2502	33.54	20.08
2513	31.14	18.64
2573	16.77	10.04
2582	16.77	10.04
2592	118.57	70.99
2593	98.21	58.80
2602	11.98	7.17
2603	87.43	52.35
2692	55.09	32.99

SERVICE STATION INVENTORY 11/16/78

SQUARE MILE	STORAGE 1000 GALLONS	EMISSIONS 1000 LBS/YR
2693	45.51	27.25
2703	82.64	49.48
2792	47.91	28.68
2793	216.78	129.79
2803	14.37	8.61
2892	47.91	28.68
2893	130.55	78.16
2903	116.18	69.56
2904	4.79	2.87
2992	19.16	11.47
2993	62.28	37.29
2994	28.74	17.21
3003	75.46	45.18
3004	40.72	24.38
3014	3.59	2.15
3093	161 69	96.81
3094	28.74	17.21
3103	100.61	60.24
3104	150.91	90.35
3113	19.16	11.47
3192	3.59	2.15
3193	129.35	77.45
3194	19.16	11.47
3203	16.77	10.04
3204	51.50	30.83
3292	23.95	14.34
3293	103.00	61.67
3303	43.12	25.82
3393	81.44	48.76
3402	57.49	34.42
3403	185.64	111.15
3492	82.64	49.48
3493	107.79	64.54
3502	17.97	10.76
3503	131.75	78.88
3583	19.16	11.47
3593	86.23	51.63
3602	11.78	7.17
3603	71.86	43.02
3692	138.93	83.18
4021	23.95	14.34
TOTALS	9641.49	5772.67

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Item No. 7 Soil Farming Data

Soil farming data was requested from the various industries. The information received is compiled on the following table.

Type of waste, square mile grid location, area, total waste in barrels per year, per cent oil content in waste, and barrels per August and September are listed on the table.

Waste	Sq. Mile Grid	Area	Total bbls/yr.	% Oil content	Aug-Sept (bbls.)
Oily Sludge	3272 (Creek Co.)	113 acres	260,975	50	43,615
Bio-Sludge	1492	5.5 acres	52,000	.26	8,714
Tetraethyl lead sludge	1492		48	25	N/A
Tank Bottom sludge	1492	20 acres	13,095	35	2,182
Oily Sludge	1092	3,120 sq.ft.	180	25	56
Leaded Sludge	1092	2.8 acres	6	25	6
Oily Waste (Pond retention)	3272 (Creek Co.)	3.67 acres	104,025	50	17,385

January 16, 1979

Item No. 8 Cutback Asphalt Usage

The Tulsa County Engineer and various asphalt companies were contacted regarding the use of cutback asphalt.

The County Engineer sent a letter responding to the use of cutback asphalt and a copy is included.

The total usage of cutback asphalt in Tulsa County was received from five companies. The totals and emissions are listed in the following pages. The emission factors were obtained from RACT documents from EPA.

January 15, 1979
G.E.B.

HYDROCARBON EMISSIONS FOR 1977 FROM USE OF CUTBACK ASPHALT

The following companies reported the usage of cutback asphalt for 1977 in Tulsa County:

1.	Anchor-Amulco (MC)	522,215 gallons
2.	Monarch Asphalt (MC)	7,500 gallons
3.	Standard Industries (MC)	192,970 gallons
4.	Tulsa Rock (McMichael) (MC)	145,000 gallons
	Tulsa Rock (MCMichael) (SC)	24,000 gallons
	Tulsa Rock (McMichael) (RC)	14,000 gallons
5.	Cummins Construction Co. (MC)	25,316 gallons

Cutback asphalt weights approximately 7.82 pounds per gallon.

The percentage of diluent to evaporate is:
SC 25% average
MC 70% average
RC 80% average

The fraction of diluent, assume 35% by volume, therefore, by weight:

SC 31.1%
MC 29.8%
RC 25.5%

Total cutback asphalt used in Tulsa County for 1977:

MC 894,001 gallons
SC 24,000 gallons
RC 14,000 gallons

Emissions are based on factors from EPA-450/2-77-037, Control of VOC From Use of Cutback Asphalt.

Hydrocarbon emissions = cutback asphalt (tons/yr.)
x fractions diluent x fraction of diluent that evaporates

Total hydrocarbon emissions

SC = 24,000 gal. (7.82) (.25) (.311) = 7.3 T/yr.

MC = 894,001 gal. (7.82) (.70) (.298) = 729.17 T/yr.

RC = 14,000 gal. (7.82) (.80) (.255) = 11.17 T/yr.

Tulsa County Cutback Asphalt HC Emissions for 1977 747.64 T/yr.

Tulsa County

County Engineer

A Department of the Board of County Commissioners
Tulsa County Administration Bldg. • 500 South Denver
Tulsa, Oklahoma 74103 • (918) 584-0471

RAY JORDAN
COUNTY ENGINEER

December 30, 1977

Roger Randolph
City-County Health Department
4116 East 15th
Tulsa, Oklahoma 74112

Dear Roger:

We are attaching our report on usage of cutback asphalt by Tulsa County highway departments.

I hope this information is sufficient. If we can help further, please contact us again.

Very truly,

Ray Jordan

Ray Jordan, P. E.
County Engineer

RJ/june
attm.

REPORT . . . on Tulsa County's usage of cutback asphalt.

Tulsa County highway departments used 85,774 gallons of cutback asphalt from May 1977 to October 1977. This was all MC grade oil. We did not use any RC or SC grade oil.

In reference to question on how this will affect our operations, Tulsa County uses cutback asphalts in the following operations:

A. Seal coating, what is commonly called chip seal. This operation uses approximately 3,000 gallons MC oil per mile depending on width of road being surfaced.

Cationic emulsified asphalts can be used in place of cutback asphalts for this operation. Some minor procedure changes will have to be made in the way the material is handled and the way the paving operation itself is conducted.

B. Mixing of rock, oil and soil, commonly known as preparation of oil mat for base material - this operation uses approximately 10,000 gallons per mile per inch of thickness. Tulsa County does very little of this for preparing a totally new base. Anionic emulsified asphalt can be used in place of cutback asphalts for this operation. This change would require Tulsa County to make some minor operational changes.

C. Penetration coat - this operation involves the use of cutback asphalt in preparation of subgrade or rock base for asphaltic concrete overlays. This involves using approximately 0.3 gallons per square yard of surface. The cutback asphalt penetrates the soil or rock whichever is used and makes moisture seal in top 2 or 3 inches of material where penetration shot is used. Our use of this type of application is limited and probably would not exceed 20,000 gallons per year. At present time I do not know of any material that is used for substitute.

If emulsified asphalt is used the water penetrates the surface, but the emulsion itself stays on surface as film and is tracked up by equipment in paving operation.

Tulsa County's project usage of cutback asphalts for chip sealing would be 170 miles of surfacing for year of 1978. This would amount to approximately 510,000 gallons. There are some cost advantages for Tulsa County to switch to emulsion for chip sealing, but at present time, we have some contracts for cutback asphalt which will probably account for approximately 100,000 gallons of the 510,000 gallons projected usage. I request that we be allowed to complete existing contracts with the understanding that we convert to emulsion as these contracts are completed. As to time frame involved, I do not know, therefore, I would request that we be allowed to complete contracts between January 1,1978, and October 1, 1978.

I would also request that variance procedure be incorporated if and when Tulsa County might want to use cutback asphalts for penetration coat operation. I think we can overcome problems involved in operation.

Item No. 9 On-site Incineration

The following is a list of incinerators in Tulsa County. The report includes street addresses, maximum design capacity, and emissions (lbs/hr) for particulates, SOx, CO, HC, and NOx. The emissions are calculated based on reported hours of operation and emission factors from EPA document AP42.

Sq. Mi. Grid		Max. Design Capacity	Emissions lbs/yr.				
			Part.	SOx	CO	HC	NOx
1794	Skaggs Albertson 11333 E. 31st St.	700 lbs/hr.	3577	1277	5110	1533	1533
2793	Sheridan Discount 5046 S. Sheridan	500 lbs/hr.	3094	1105	4420	1326	1326
0794	Plaza Red Bud 1130 S. Garnett	375 lbs/hr.	2116	756	3022	907	907
0193	Meadowood Red Bud 9212 E. Admiral Pl.	100 lbs/hr.	655	234	936	291	291
0194	Rolling Hills Red Bud 19296 E. Admiral Pl.	300 lbs/hr.	1966	702	2808	842	842
1293	Skaggs Albertson 1939 S. Memorial	600 lbs/hr.	2299	877	3510	1053	1053
2593	Tulsa Bldg. Supply 8516 E. 41st	130 lbs/hr.	118	42	169	51	51
2603	Board of Education 1555 N. 77th E. Ave.	100 lbs/hr.	73	26	104	31	31
2293	Woolco 4903 E. 41st	1000 lbs/hr.	637	228	910	273	273
0383	St. Francis Hospital 6161 S. Yale	600 lbs/hr.	546	195	780	234	234
1994	Giant Discount 11005 E. 41st	375 lbs/hr.	3276	1170	4680	1404	1404
3104	Crosstown Discount 10061 E. Admiral Pl.	375 lbs/hr.	3276	1170	4680	1404	1404
2893	Amoco Research 4502 S. Yale	1000 lbs/hr.	910	325	1300	390	390
0593	Bama Pie 2745 E. 11th St.	750 lbs/hr.	3412	1219	4874	1462	1462
0703	Bestyet Foods 4601 N. Peoria	400 lbs/hr.	1100	393	1571	471	471

Sq. Mi. Grid		Max. Design Capacity	Emissions lbs/yr. Part.	SOx	CO	HC	NOx
2492	Brookside State Bank 3237 S. Peoria	130 lbs/hr.	237	85	339	102	102
2993	Edison High School 2906 E. 41st	100 lbs/hr	252	90	360	108	108
1093	Evans Electric 2002 Southwest Blvd.	100 lbs/hr.	819	293	1170	351	351
1693	Doctors Hospital 2323 S. Harvard	25 lbs/hr.	127	45	181	54	54
1783	Oral Roberts Assn. 8100 S. Delaware	450 lbs/hr.	819	293	1170	351	351
0192	Page Milk Co. 519 E. 7th St.	750 lbs/hr.	1365	488	1950	585	585
1893	Petty's Fine Foods 1964 Utica Square	150 lbs/hr.	164	59	234	70	70
3393	Skaggs Drug Center 3328 E. 51st.	300 lbs/hr.	1310	468	1871	561	561
0593	Tulsa University 600 S. College	100 lbs/hr.	182	65	260	78	78
1783	University Village 8555 S. Lewis	600 lbs/hr.	1310	468	1871	561	561
	Totals in lbs/yr.		33,640	12,073	48,280	14,483	14,483
	Totals in tons/yr.		16.8	6	24	7.2	7.2

Item No. 10 Dry Cleaning

Inventory forms were developed and sent to all dry cleaning establishments in Tulsa County.

The information received was compiled to develop the emissions. The emissions were developed using emission factors from AP-42 and basic knowledge of the process.

The inventory questionnaires had a 90% return, therefore the total emissions were adjusted 10% to allow for those not received.

The inventory indicated 21% of the dry cleaning was done in August and September.

Cleaning operations were done 63.3% of the time between 6 a.m. and 12 noon according to the information received.

The following pages list emissions per square mile, total emissions, emissions during August and September, and emissions during the morning hours.

Nov. 3, 1978
William L. Gibbons

Item No. 10 ORGANIC MATERIALS EMISSIONS

1977-Dry Cleaning

1. Total Emissions

Petroleum solvents	242 tons
Perchloroethylene	349 tons
	591 tons/yr.

2. Emissions Aug. through September

   Based on 21% of materials are cleaned in Aug.-Sept.

   Emissions = 591 x .21 = 124.11 tons

3. Cleaning operations 6-12 a.m.

   63.3% of cleaning during time period.

   591 x .633 = 374 tons/yr.

   124.11 x .633 = 78.56 T/Aug.-Sept.

November 7, 1978

ORGANIC MATERIALS EMISSIONS
1977-Dry Cleaning by Square Mile

Square Mile No.	T/Yr.	T/Aug-Sept.
0282	3.9	.82
0583	3.5	.74
1183	3.2	.67
1983	4.2	.88
0284	3.6	.76
1184	14.6	3.07
1484	3.8	.80
1191	14.0	2.94
1291	3.5	.74
2391	6.1	1.28
0192	16.4	3.44
0492	5.4	1.13
1292	6.9	1.45
2492	3.5	.74
2692	2.5	.53
2892	3.5	.74
3392	3.1	.65
0293	5.5	1.16
0593	8.4	1.76
0693	3.1	.65
0793	17.6	3.70
0893	8.4	1.76
0993	28.1	5.90
1093	80.1	16.82
1193	55.1	11.57
1393	6.1	1.28
1493	6.8	1.43
1593	3.1	.65
1693	8.3	1.74
1993	15.1	3.17
2093	5.7	1.20
2293	4.1	.86
2393	18.1	3.80
2593	19.5	4.10
2693	18.4	3.86
2893	9.1	1.91
2993	8.9	1.87
3093	5.8	1.22
3193	10.8	2.27
3493	3.6	.76
0694	3.6	.76
0794	4.3	.90
0894	3.5	.74
0994	4.5	.95
1994	8.3	1.74
2094	6.1	1.28
0102	3.6	.76
2402	5.8	1.22

Square Mile No.	T/Yr.	T/Aug-Sept.
3402	3.6	.76
3602	14.0	2.94
0703	6.1	1.28
1903	7.4	1.55
2703	7.5	1.58
2803	10.5	2.21
2903	13.1	2.75
3003	9.2	1.93
3103	5.1	1.07
3203	3.8	.80
3303	6.8	1.43
3503	2.4	.50
3603	3.8	.80
3612	3.5	.74
3014	7.4	1.55
TOTALS	591	124.11

June 26, 1978
William L. Gibbons

Item No. 11 COAL USAGE FOR HEATING PURPOSES

This report is in regard to the numbers of heating devices where coal is used as the heating source for commercial or residential buildings in Tulsa.

Mr. Scotty West, Tulsa City Building Inspector states that he has no knowledge of the use of coal for heating. Mr. West querried the city boiler inspector who also knows of any boilers for space heating which use coal.

Mr. West stated that installations in the past several years are generally installed with provision for conversion to fuel oil in lieu of natural gas.

Item No. 12 Aircraft Emissions

The aircraft emissions were calculated by our office using information received from Engineering-Science.

The LTO cycles and breakdowns into individual categories were obtained from telephone conversations with the airport managers by Engineering-Science.

The emissions factors were all taken from AP-42.

The following table list the emission calculated and the square mile location of each airport.

9-27-78

AIRCRAFT EMISSIONS

Tons/Yr.

Aircraft	No. of Engines	LTO's	Part.	SO_x	CO	HC	NO_x
Tulsa International -Sq.Mi. 2303 & 2403							
Long range jets	4	4,690	11.35	14.63	444.61	386.46	74.10
Med. range jets	2.75	18,759	10.58	26.05	438.49	126.39	263.09
Piston Transport	4	480	.54	.27	291.84	39.07	.38
Air carrier turboprop	2	4,320	.86	.78	13.39	4.75	5.18
Military							
Jet	2	3,574	1.11	2.72	53.97	35.49	11.76
Piston	1	150	.02	.01	11.40	1.53	.02
Helicopter	2	38	.01	.01	.22	.02	.02
General Aviation							
Business jet	2	23,836	2.62	8.82	376.61	85.81	38.14
Turboprop	2	35,754	35,75	6.44	110.84	39.33	42.90
Piston	1	11,918	.12	.08	72.70	2.38	.28
Jones (Riverside) Airport -Sq. Mi. 1382							
General Aviation							
Business jet	2	786	.09	.03	12.42	2.83	1.26
Single-engine piston	1	144,391	1.44	1.01	880.79	28.88	3.39
Twin-engine piston	2	11,001	.22	.15	134.21	4.40	.52
Air carrier turboprop	2	230	.05	.04	.71	.25	.28
Military							
Helicopters	2	7	Neg	Neg	.04	Neg	Neg
Tulsa Downtown Air Park -Sq.Mi. 1502 (Osage County)							
Piston	1	21,600	.22	.15	131.76	4.32	.51
Harvey Young Airport -Sq. Mi. 0994							
Piston	1	5,400	.05	.04	32.94	1.08	.13
Aircraft Emissions Tulsa County (tons/yr.)							
Totals			65	61	3007	763	442

Item No. 13 OPEN BURNING HOUSEHOLD REFUSE

City of Tulsa (Environmental Survey)

3.4 people/house 4.5 lbs/refuse/person/day

15.3 lbs/refuse/house/day = 5585.5 lbs/refuse/house/year

577.99 T/yr. x 16 = 4.62 T/yr. Part.

577.99 T/yr. x 1 = 578 lbs/yr. SO_x

577.99 T/yr. x 85 = 24.56 T/yr. CO

577.99 T/yr. x 30 = 8.67 T/yr. HC

577.99 T/yr. x 6 = 1.74 T/yr. NO_x

County of Tulsa

2.6 people/house 4.5 lbs/refuse/person/day

11.7 lbs/refuse/house/day = 4270.5 lbs/refuse/house/year

County Population: 27,150 people x 2.6 people/house

10,442 houses x 60% of total burned trash

6,265 x 4,220.5 = 13,378 T/yr.

13,378 T/yr. x 16 = 107 T/yr. Part.

13,378 T/yr. x 1 = 6.7 T/yr. SO_x

13,378 T/yr. x 85 = 568 T/yr. CO

13,378 T/yr. x 30 = 200 T/yr. HC

13,378 T/yr. x 6 = 40 T/yr. NO_x

APPENDIX E

TULSA COUNTY REGULATION 15

SECTION 215

Control of Emissions of Organic Materials

A. Purpose

The purpose of this regulation is to control the emission of organic materials from stationary sources in order to protect and enchance the air quality, to insure that the Oklahoma air quality standards are not exceeded and significant deterioration is prevented in the City of Tulsa.

B. Storage of Volatile Organic Compounds Greater than 40,000 gallons (952 bbls)

No person shall build, sell, operate, install or permit the building, operation or installation of any stationary tank, reservoir or other container of more than 952 barrels capacity which is used for storage of any volatile organic compounds unless such tank, reservoir or other container is a pressure tank capable of maintaining working pressures sufficient at all times to prevent organic vapor or gas loss to the atmosphere, or is designed, and built and equipped with one or more of the following vapor-loss control devices:

1. A floating roof, consisting of pontoon type, internal floating cover or double-deck type roof, which rests on the surface of the liquid contents and which is equipped with a closure seal, or seals to close the space between the roof edge and tank wall. Provided however, new open floating roof tanks must have double seals or equivalent. Such floating roofs are not appropriate control devices if the volatile organic compounds have a vapor pressure of 11.0 pounds per square inch absolute

(568mm Hg) or greater under actual conditions. All gauging and sampling devices shall be vapor tight except when gauging or sampling is taking place.

2. A vapor gathering system and vapor disposal/recovery system that discharges to the atmosphere no more than 0.67 lbs/10^3 gallons throughput or 80 mg/liter of organic materials from the control equipment. All tank gauging and sampling devices shall be vapor tight except when gauging or sampling is taking place.

3. Other equipment or means of equal efficiency or greater for purposes of air pollution control as may be approved by the Director.

4. Provisions of paragraph B shall not apply to crude oil or condensate prior to first custody transfer and which is stored in vessels of less than 10,000 barrels capacity; this exemption shall apply to these storage vessels in being on the effective date of this regulation.

C. Gasoline Service Stations

1. Storage. No person shall build, sell, install, operate or permit the building, installation or operation of any stationary, permanent organic material storage tank with a capacity greater than 400 U.S. gallons and less than 40,000 U.S. gallons unless such tank is bottom filled or is equipped with a permanent submerged fill pipe (drop tube) and tight-fill cap or is equipped with other devices of equal or greater efficiency.

2. Unloading. All loading of the above organic material storage tank shall be conducted by "tight-fill".

D. **Bulk Gasoline Plants**

Bulk plants shall be equipped so as to maintain a 97% submergence factor during transfer of gasoline.

E. **Terminals - Bulk Gasoline Terminals**

No person shall build, operate, install or permit the building, operation or installation of a stationary gasoline loading facility unless such loading facility is equipped with a vapor-collection and/or disposal system properly installed, in good working order and operating in conformance with the following requirements:

1. When gasoline is loaded through the hatches of a transport vessel, a pneumatic, hydraulic or mechanical means shall be provided to ensure a vapor-tight seal at the hatch.
2. A means shall be provided to prevent gasoline drainage from the loading device when it is removed from the transport vessel, or to accomplish complete drainage before removal.
3. When loading is effected through means other than hatches, all loading and vapor lines shall be equipped with fittings which make vapor-tight connections and which close automatically when disconnected.
4. The vapor collection and/or disposal portion of the system shall consist of one or more of the following:
    a. An absorber/adsorber system or condensation system that discharges (into the atmosphere) no more than, 0.67 lb/1000 gal. throughput or 80 mg/liter of organic compounds.
    b. A vapor handling system which directs all vapors to a fuel gas incineration system with a minimum disposal efficiency of 99%.

c. Other equipment which discharges no more than 80mg/l, provided plans for such equipment are submitted to and approved by the Director.

5. Storage vessels, as described in Sub-Section 215-C of this section, may be used for intermediate storage prior to disposal of vapors as per A, B, C, if they are designed to prevent the release of vapors during use. This sub-section shall apply to any facility which loads gasoline into any transport or delivery vessel designed for transporting gasoline and which has a capacity greater than 250 gallons.

F. Transport and Delivery Vessels used with Vapor Recovery Systems

No person shall operate or permit the operation of a vapor-laden transport or delivery vessel unless it meets the following requirements:

1. The vessel shall be so designed and operated as to be vapor-tight except when sampling or gauging.
2. The vessel shall be equipped and operated so that the gasoline vapors are delivered to a vapor recovery/disposal system.
3. There shall be no leaks between the delivery and storage vessels.

G. Refinery Wastewater (oil/water) Separators

No person shall build, operate or install or permit the building, operation or installation of a single or multiple compartment wastewater (oil/water) separator which receives effluent water containing 100 gallons per day or more of any organic material from any equipment processing, refining, treating, storing or handling organic material in refineries unless the compartment receiving said wastewater is equipped with at least one of the following vapor control devices, properly installed, in good working order and in operation:

1. A container having all openings sealed and totally enclosing the liquid contents. All gauging and sampling devices shall be vapor-tight except when gauging or sampling is taking place. The oil removal devices shall be vapor-tight except when manual skimming, inspection and/or repair is in progress.
2. A container equipped with a floating roof, consisting of a pontoon type, double-deck type roof, or internal floating cover, which will rest on the surface of the contents and is equipped with a closure seal, or seals, to close the space between the roof edge and container wall. All gauging and sampling devices shall be vapor-tight except when gauging or sampling is taking place. The oil removal devices shall be vapor-tight except when manual skimming, inspection and/or repair is in progress.
3. A container equipped with a vapor-recovery system, consisting of a vapor-gathering system capable of collecting the organic material vapors and gases discharged and a vapor-disposal system capable of processing such organic material vapors and gases so as to prevent their emission to the atmosphere and will all tank gauging and sampling devices vapor-tight except when gauging or sampling is taking place. The organic material removal devices shall be vapor-tight except when manual skimming, inspection and/or repair is in progress.
4. Containers equipped with controls of equal efficiency or greater, provided plans and specifications of such equipment are submitted and approved by the Director.

H. Pumps and Compressors

No person shall build, install or operate or permit the building, operation or installation of any pump or compressor handling organic materials unless rotating type pumps and compressors are equipped with mechanical seals or other equipment of equal efficiency or greater; or reciprocating type pumps and compressors which are equipped with packing glands properly installed and in good working order such that the emissions from the drain recovery systems are limited to two cubic inches of liquid organic materials in 15 minute period at standard conditions per pump or compressor and limited to a volatile organic compound concentration of 1,000 ppm as hexane at 5 centimeters from the surface as measured by a volatile organic compound leak detector.

I. Ethylene Manufacturing Emissions

No person shall build, install, operate or permit the building, installation, or operation of any ethylene manufacturing plant unless the waste-gas stream, under normal operating conditions, is properly burned at 1300°F for 0.3 seconds or greater in a direct-flame after burner equipped with an indicating pyrometer which is positioned in the working area for the operator's ready monitoring or an equally effective catalytic vapor incinerator also equipped with pyrometer. Proper burning of the waste-gas stream is defined as reduction by 98 percent of the Ethylene emissions originally present in the waste-gas stream.

J. Vapor Blow-down and Process Unit Turnaround

No person shall cause or permit the start-up, shut-down, purge and blow-down of any processing unit unless the following requirements are met:

1. Process vessels shall be free of liquid contents. Volatile organic material vapors shall be purged to disposal systems which emit no more than 80 mg/l of volatile organic compounds to the atmosphere. Vessels shall not be vented to the atmosphere unless 90% or more of the volatile organic compound vapors are removed to the disposal systems.
2. In the event that "1" above cannot be complied with because of unit configuration or safety conflicts, then a detailed written plan shall be submitted to the Director at least 15 days prior to turnaround, indicating what steps will be used to minimize volatile organic compound emissions to the atmosphere.
3. At least 15 days prior to a scheduled turnaround a written report shall be submitted to the Director for approval. As a minimum the report shall indicate the unit to be shutdown, the date of shut-down and the approximate quantity of volatile organic compounds to be emitted to the atmosphere.
4. Storage vessels operated at atmospheric pressure are exempt from this sub-section.

K. Vacuum Producing Systems

No person shall operate or cause the operation of a vacuum producing system unless the non-condensable organic materials from the following equipment shall be controlled so that vapors of volatile organic compounds emitted to the atmosphere shall not exceed 80 mg/liter.

1. Steam ejectors with barometric condensers
2. Steam ejectors with surface condensers
3. Mechanical vacuum pumps

4. Hot wells

5. Accumulators

L. Miscellaneous Sources

No person shall operate or cause the operation of miscellaneous sources such as, process drains and drainage systems, valves, flanges and other pipe connections, pressure relief devices, and sampling connections unless they are controlled so as to prevent the release of volatile organic compound vapors in excess of 1,000 ppm (as hexane) measured at 5 cm from the surface.

M. Monitoring and Maintenance

Refinery operators shall be required to routinely monitor and maintain a log for the various emission sources of volatile organic compounds as follows:

Ambient votatile organic compound concentration is to be monitored daily around each process unit and waste water treatment facility with a portable volatile organic compound detecter. Ambient readings in excess of 100 ppm (as hexane) and the source of the volatile organic compounds shall be recorded in the log. A volatile organic compound concentration between 1,000 an 10,000 ppm at 5 cm distance from the leak is considered a small leak. These leaks shall be repaired within one week from the time they are noted. A tag shall be dated and placed on the leaking component and shall not be removed until the component is repaired. If the concentration exceeds 10,000 ppm of volatile organic compounds (as hexane) at 5 cm it shall be recorded as a large leak and maintenance shall be performed within 48 hours. A permanent log of such leaking components and their repairs shall be maintained and available to the Director for inspection during normal working hours. Leaks that are not repaired within the time specified shall be reported in writing to the Director.

N. Monitoring Instruments

Monitoring instruments used to conform to the requirements of Section 215, shall be of a type or model approved by the Director. Monitoring methods shall conform to state or federal requirements or as approved by the Director.

O. Organic Solvents, Diluents, and Other Waste Gas Streams Containing Organic Materials

Exception: This sub-section shall not apply to surface coating operations or solvent metal cleaning.

1. Heat Drying

No person shall cause or allow the discharge into the atmosphere of more than 15 pounds of organic materials in any one day, or more than 3 pounds in any one hour, from any article, machine, equipment or other contrivance in which any organic solvent or diluent, or any material containing organic solvents or diluents comes into contact with flame or is baked, heat cured, or heat polymerized in the presence of oxygen. Those portions of any series of articles, machines, equipment or other contrivances designed for processing a continuous web, strip or wire which emit volatile organic compounds and which use operations described in this sub-section shall be collectively subject to compliance with this sub-section.

2. Other Uses

No persons shall cause or allow the discharge into the atmosphere of more than 40 pounds of organic materials in any one day, or more than 8 pounds in any one hour, from any article, machine, equipment or other contrivance for employing, applying, evaporating or drying any organic materials. Emissions of organic materials into the atmosphere resulting from air drying of products for the first 12 hours after their removal from any article, machine, equipment or other contrivance described in this sub-section shall be included in determining compliance with this sub-section. Emissions resulting from baking, heat curing, or heat polymerizing as described in subsection 1 shall be excluded from determination of compliance with this sub-section. Those portions of any series of articles, machine, equipment or other contrivances designed for processing a continuous web, strip or wire which emit organic materials and which use operations described in this sub-section shall be collectively subject to compliance with this sub-section.

3. Clean Up with Organic Solvents

Emissions of volatile organic materials to the atmosphere from the clean up with organic solvents of any article, machine, equipment or other contrivance described in Section 1 and 2 shall be included with the other emissions of organic materials from that article, machine, equipment or other contrivance for determining compliance with this regulation.

4. Alternate Standard

Emissions in excess of those permitted by sub-sections 1, 2, and 3 of this regulation are allowable if both the following conditions are met:

a. Emissions that would result in the absence of control are reduced by:

(1) 90 percent, by incineration; or

(2) 85 percent, by absorption or any other process of equivalent reliability and efficiency and

b. No air pollution, as defined herein, occurs.

P. Control of Organic Solvents from Surface Coatings

1. Limitations

This regulation limits the volumetric quantities of organic solvents contained in surface coating materials at application viscosity, in:

a. Industrial surface coating operations exclusive of aircraft coatings.

b. Architectural surfacing coatings which are applied by professional trades, surface coating equipment operators or painters.

2. After January 1, 1980, no person shall cause, suffer, allow or permit the use of the coating material types which contain organic solvents in excess of the quantities indicated in Table I.

TABLE I

Maximum Allowable Content
of Organic Solvents by Surface Coating
Material Type

Type of Surface Coating Material Type	Organic Solvents Allowable* After January 1, 1980
Alkyd Primer	65
Vinyls & Lacquers	80
Acrylics	80
Epoxies	60
Maintenance Enamels	60
Custom Product Enamels	60

*percent by volume

3. After January 1, 1981, no person shall cause, suffer, allow or permit the use of surface coating materials types, which contain organic solvents in excess of the quantities indicated in Table II.

TABLE II

Maximum Allowable Content of
Organic Solvents by Surface
Coating Material Type

Type of Surface Coating Material	Organic Solvents Allowable* After January 1, 1981
Alkyd Primer	60
Vinyls & Lacquer	75
Acrylics	75
Epoxies	60
Maintenance Enamels	55
Custom Product Enamels	55

*percent by volume

Q. Control of Organic Materials from Solvent Metal Cleaning (Degreasing)

1. Cold Cleaning Systems

   a. No person shall operate or maintain a system utilizing an organic material for the cold cleaning of objects without a cover, cleaned parts drainage facility, and a permanent conspicuous label which summarizes the operating requirements.

b. No person shall operate or maintain a system using an organic material for the cold cleaning of objects without complying with the following operating procedures:

(1) Waste solvent shall not be disposed of or transferred to another party such that greater than 20 percent of the waste (by weight) can evaporate into the atmosphere. Waste solvent shall be stored only in covered containers.

(2) The degreaser cover shall be closed whenever parts are not being handled in the cleaner.

(3) Parts shall be drained for at least 15 seconds or until dripping ceases.

c. Small cold cleaning operations using wipe-on applications are exempt.

2. Open Top Vapor Degreasers

a. No person shall operate or maintain a system utilizing an organic material for the open top vapor cleaning of objects without a cover that can be opened and closed easily without disturbing the vapor zone.

b. No person shall operate or maintain a system using an organic material for the open top vapor cleaning of objects without complying with the following operating procedures:

(1) The cover shall be closed at all times except when processing work loads through the degreaser.

(2) Parts shall be positioned so that maximum drainage is obtained.

(3) Parts shall be moved in and out of the degreaser at less than 3.3 M/Min (11 Ft/Min).

(4) The work load shall be degreased in the vapor zone at least 30 seconds or until condensation ceases.

(5) Any pools of solvent on the cleaned parts shall be removed by tipping the part before withdrawing the part.

(6) Parts shall be allowed to dry within the degreaser for at least 15 seconds or until visually dry.

(7) Porous or absorbent materials such as cloth, leather, wood or rope shall not be degreased.

(8) Work loads shall not occupy more than half of the degreaser open top area.

(9) The vapor level shall not drop more than 10 CM (4 in.) when the work load enters or is removed from the vapor zone.

(10) Solvent shall not be sprayed above the vapor level.

(11) Solvent leaks shall be repaired immediately or the degreaser shall be shut down.

(12) Waste solvent shall not be disposed of or transferred to another party such that greater than 20 percent of the waste (by weight) will evaporate into the atmosphere.

(13) Exhaust ventilation shall not exceed 20 M^3/Min per M^2 (65 CFM per Ft^2) of degreaser open area, unless necessary to meet OSHA requirements. Ventilation fans shall not be used near the degreaser opening.

(14) Water shall not be visibly detectable in solvent exiting the water separator.

(15) Leaks shall be repaired immediately or the degreaser unit shall be shutdown.

(16) Exhaust ventilation shall not exceed 65 cubic feet per minute (CFM) per square foot of surface area unless necessary to meet Occupational Safety and Health Administration (OSHA) requirements. Ventilation fans shall not be used near the degreaser.

(17) Water shall not be visible in the solvent exiting the water separator.

c. A permanent, conspicuous label summarizing the requirements of Section b above shall be posted on or near the degreaser.

R. Cutback Asphalt Paving

The use of cutback asphalt for paving or surface coating in the City of Tulsa is prohibited except by written permission granted by the Director.

S. Exemptions

The following organic materials are exempt from all provisions of Section 215.

1. 1, 1, 1, Trichloroethane (Methyl Chloroform)
2. Trichlorotrifluoroethane (Freon 113)
3. Methane
4. Ethane

T. Section 215 shall become effective upon adoption by the City Commission; provided that existing installations shall comply on or before July 1, 1981, unless otherwise specified herein.

APPENDIX F

MOBILE 1 HIGHWAY EMISSION FACTORS

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MOBILE EMISSIONS TULSA ENVIRONS

  *   TOTAL HC EMISSION FACTORS INCLUDE EVAP. HC EMISSION FACTORS
---------------------------------------------------------------------------
                                VEH. TYPE:  LDV    LDT1  LDT2  HDG   HDD   MC
CAL. YEAR: 1977     TEMP: 85.0(F)         0.738/0.180/0.030/0.020/0.030/0.002
REGION: 49-STATE    55.0:55.0/55.0/55.0 MPH (55.0)         5.0/  5.0/  5.0

                          COMPOSITE EMISSION FACTORS (GM/MILE)
                 LDV       LDT1     LDT2      HDG      HDD      MC     ALL MODES
   TOTAL HC:    3.96       4.46     6.96     11.44     2.40     6.14      4.25
   *EVAP HC:    2.02       2.22     3.53      2.92     0.0      1.60      ----
EXHAUST  CO:   21.16      23.53    29.90    162.57    14.07    16.39     24.46
EXHAUST NO :    3.96       4.01     7.26     13.96    28.50     0.17      5.00
---------------------------------------------------------------------------
                                VEH. TYPE:  LDV    LDT1  LDT2  HDG   HDD   MC
CAL. YEAR: 1977     TEMP: 85.0(F)         0.828/0.140/0.020/0.005/0.005/0.002
REGION: 49-STATE    45.0:45.0/45.0/45.0 MPH (45.0)        10.0/ 10.0/ 10.0

                          COMPOSITE EMISSION FACTORS (GM/MILE)
                 LDV       LDT1     LDT2      HDG      HDD      MC     ALL MODES
   TOTAL HC:    4.30       4.83     7.40     12.13     2.53     6.59      4.47
   *EVAP HC:    2.02       2.22     3.53      2.92     0.0      1.60      ----
EXHAUST  CO:   25.22      27.77    34.20    141.21    14.27    18.09     26.27
EXHAUST NO :    3.69       3.73     6.66     13.06    21.23     0.16      3.88
---------------------------------------------------------------------------
                                VEH. TYPE:  LDV    LDT1  LDT2  HDG   HDD   MC
CAL. YEAR: 1977     TEMP: 85.0(F)         0.782/0.128/0.036/0.017/0.007/0.030
REGION: 49-STATE    20.0:20.0/20.0/20.0 MPH (20.0)        21.0/ 27.0/ 21.0

                          COMPOSITE EMISSION FACTORS (GM/MILE)
                 LDV       LDT1     LDT2      HDG      HDD      MC     ALL MODES
   TOTAL HC:    7.01       7.84    11.28     28.76     4.42    11.03      7.74
   *EVAP HC:    2.02       2.22     3.53      2.92     0.0      1.60      ----
EXHAUST  CO:   58.20      62.57    76.55    268.72    30.27    33.93     62.07
EXHAUST NO :    3.17       3.21     5.32     10.75    20.62     0.14      3.41
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MOBILE EMISSIONS TULSA ENVIRONS 1982

 *   TOTAL HC EMISSION FACTORS INCLUDE EVAP. HC EMISSION FACTORS
---------------------------------------------------------------------------------
                          VEH. TYPE:  LDV   LDT1  LDT2  HDG   HDD   MC
 CAL. YEAR: 1982     TEMP: 85.0(F)        0.738/0.180/0.030/0.020/0.030/0.002
 REGION: 49-STATE    52.0:52.0/52.0/52.0 MPH (52.0)        5.0/  5.0/  5.0

                     COMPOSITE EMISSION FACTORS (GM/MILE)
                  LDV       LDT1      LDT2      HDG      HDD       MC      ALL MODES
   TOTAL HC:     1.93       2.66      4.66      7.75     2.12      2.25       2.27
   *EVAP HC:     0.91       1.03      1.97      2.02     0.0       0.27       ----
 EXHAUST  CO:   13.83;     21.62     26.81    156.12    11.03      7.92      18.37
 EXHAUST NO :    2.76       3.03      5.05     13.07    28.58      0.48       3.85
---------------------------------------------------------------------------------
                          VEH. TYPE:  LDV   LDT1  LDT2  HDG   HDD   MC
 CAL. YEAR: 1982     TEMP: 85.0(F)        0.828/0.140/0.020/0.005/0.005/0.002
 REGION: 49-STATE    43.0:43.0/43.0/43.0 MPH (43.0)       10.0/ 10.0/ 10.0

                     COMPOSITE EMISSION FACTORS (GM/MILE)
                  LDV       LDT1      LDT2      HDG      HDD       MC      ALL MODES
   TOTAL HC:     2.14       2.95      5.02      8.60     2.33      2.60       2.34
   *EVAP HC:     0.91       1.03      1.97      2.02     0.0       0.27       ----
 EXHAUST  CO:   15.75      24.27     30.54    153.43    12.19      9.05      17.90
 EXHAUST NO :    2.63       2.91      4.81     12.19    20.76      0.47       2.85
---------------------------------------------------------------------------------
                          VEH. TYPE:  LDV   LDT1  LDT2  HDG   HDD   MC
 CAL. YEAR: 1982     TEMP: 85.0(F)        0.782/0.128/0.036/0.017/0.007/0.030
 REGION: 49-STATE    20.0:20.0/20.0/20.0 MPH (20.0)       21.0/ 27.0/ 21.0

                     COMPOSITE EMISSION FACTORS (GM/MILE)
                  LDV       LDT1      LDT2      HDG      HDD       MC      ALL MODES
   TOTAL HC:     3.84       5.46      8.19     21.11     4.48      5.58       4.56
   *EVAP HC:     0.91       1.03      1.97      2.0      0.0       0.27       ----
 EXHAUST  CO:   36.17      53.90     67.14    256.79    27.63     19.86      42.77
 EXHAUST NO :    2.17       2.46      3.89      9.95    20.08      0.42       2.47
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MOBILE EMISSIONS TULSA ENVIRONS 1987

  *   TOTAL HC EMISSION FACTORS INCLUDE EVAP. HC EMISSION FACTORS
----------------------------------------------------------------------------
                                  VEH. TYPE:  LDV    LDT1  LDT2  HDG   HDD   MC
CAL. YEAR: 1987       TEMP: 85.0(F)          0.738/0.180/0.030/0.020/0.030/0.002
REGION: 49-STATE      49.0:49.0/49.0/49.0 MPH (49.0)         5.0/  5.0/  5.0

                          COMPOSITE EMISSION FACTORS (GM/MILE)
               * LDV      LDT1      LDT2      HDG       HDD       MC
  TOTAL HC:    0.85       1.54      2.45      3.37      1.44      0.48    ALL MODES
  *EVAP HC:    0.31       0.41      0.73      0.83      0.0       0.03       1.09
EXHAUST  CO:   6.99      15.55     19.62    105.05     10.61      2.42       ----
EXHAUST  NO :  2.08       2.38      3.22     10.80     17.16      0.29      10.97
                                                                             2.79
----------------------------------------------------------------------------
                                  VEH. TYPE:  LDV    LDT1  LDT2  HDG   HDD   MC
CAL. YEAR: 1987       TEMP: 85.0(F)          0.828/0.140/0.020/0.005/0.005/0.002
REGION: 49-STATE      42.0:42.0/42.0/42.0 MPH (42.0)        10.0/ 10.0/ 10.0

                          COMPOSITE EMISSION FACTORS (GM/MILE)
                 LDV      LDT1      LDT2      HDG       HDD       MC
  TOTAL HC:    0.99       1.74      2.70      4.05      1.61      0.56    ALL MODES
  *EVAP HC:    0.31       0.41      0.73      0.83      0.0       0.03       1.15
EXHAUST  CO:   8.13      17.18     21.96    106.93     11.78      2.78       ----
EXHAUST  NO :  2.03       2.35      3.17       17      13.53      0.28      10.18
                                                                             2.20
----------------------------------------------------------------------------
                                  VEH. TYPE:  LDV    LDT1  LDT2  HDG   HDD   MC
CAL. YEAR: 1987       TEMP: 85.0(F)          0.782/0.128/0.03 /0.017/0.007/0.030
REGION: 49-STATE      20.0:20.0/20.0/20.0 MPH (20.0)        21.0/ 27.0/ 21.0

                          COMPOSITE EMISSION FACTORS (GM/MILE)
                 LDV      LDT1      LDT2      HDG       HDD       MC
  TOTAL HC:    2.16       3.58      4.95     12.76      3.35      1.30    ALL MODES
  *EVAP HC:    0.31       0.41      0.73      0.83      0.0       0.03       2.60
EXHAUST  CO:  19.62      38.33     47.93    164.22     27.15      6.36       ----
EXHAUST  NO :  1.65       1.98      2.61      8.18     13.42      0.26      25.15
                                                                             1.88
----------------------------------------------------------------------------
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